“An Observational study of patients undergoing Conservative Vs Surgical Management for Adhesive Small Bowel Obstruction’’

Dissertation submitted

To

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI

With partial fulfillment of the regulations for the award of the degree of

M.S (General Surgery)

Branch-I

Government Kilpauk Medical College

Chennai- April -2014

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled ‘’**AN OBSERVATIONAL STUDY OF PATIENTS UNDERGOING CONSERVATIVE VS SURGICAL MANAGEMENT FOR ADHESIVE SMALL BOWEL OBSTRUCTION’’** is a bonafide and genuine research work carried out by me under the guidance of Prof. USHA DORAIRAJAN MS, FRCS, Department of General Surgery, Kilpauk Medical College, Chennai-10.

This dissertation is submitted to **THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY CHENNAI** in partial fulfillment of the degree of M.S. General Surgery examination to be held in **April 2014**.

Date:

Place: **Dr VARUN ARUNAGIRI**

CERTIFICATE

This is to certify that this dissertation is the bonafide work of

Dr VARUN ARUNAGIRI

On

"AN OBSERVATIONAL STUDY OF PATIENTS UNDERGOING CONSERVATIVE VS SURGICAL MANAGEMENT FOR ADHESIVE SMALL BOWEL OBSTRUCTION''

During his course in M.S. General Surgery from September 2012 to November 2013

Government Kilpauk Medical College, Chennai-10.

Prof P.N.SHANMUGASUNDARAM MS.

Professor and Head of the Department,

Department of General Surgery,

Govt Kilpauk Medical College,

Chennai-10

Prof USHA DORAIRAJAN FRCS, MS

Professor of General Surgery,

Department of General Surgery,

Govt Kilpauk Medical College,

Chennai-10

Prof. P.RAMAKRISHNAN MD, DLO

DEAN

Govt. Kilpauk Medical College, Chennai-10

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation titled **"AN OBSERVATIONAL STUDY OF PATIENTS UNDERGOING CONSERVATIVE VS SURGICAL MANAGEMENT FOR ADHESIVE SMALL BOWEL OBSTRUCTION''** is a bonafide research work done by **Dr Varun Arunagiri**, post graduate in M.S. General Surgery, Kilpauk Medical College, Chennai-10 under my direct guidance and supervision to my satisfaction, in partial fulfillment of the requirements for the degree of **M.S. General Surgery**.

Date:

Place:

Prof Usha Dorairajan. FRCS, MS.

Professor of General Surgery,

Kilpauk Medical College, Chennai-10

ACKNOWLEDGEMENT

I would like to thank God for the things he has bestowed upon me. I thank each and every person involved in making this manuscript from inception to publication.

I am most thankful to **Prof P.Ramakrishnan MD, DLO, Dean, Kilpauk Medical College and Hospital** for the opportunity to conduct this study in the Department of General Surgery, Kilpauk Medical College and Hospital, Government Royapettah Hospital, Kilpauk Medical College, Chennai-10.

My deepest gratitude to my guide and mentor **Prof. USHA DORAIRAJAN FRCS, MS,** Chief of Surgical Unit II, Department of General Surgery, Kilpauk Medical College, who has inspired me immeasurably during my training as a post graduate student.

I am very grateful to **Prof P.N.Shanmugasundaram, MS**, Head of the Department of General Surgery for the encouragement and unrestricted permission to use the Department of General Surgery.

I thank **Prof. O.L.Nagnath Babu,** Professor of Surgical Gastroenterology, Kilpauk Medical College, **Prof. Sugumar**, Professor of

Surgical Gastroenterology, Kilpauk Medical College, for guiding me through this study and his unrestricted permission to use their department for the study.

I also acknowledge the invaluable advice and counseling received from **Dr.V.Vijayalakshmi, MS, Dr.N.B.Thanmaran, MS, Dr.A.K.Kalpanadevi, MS**. This study would have not been possible without the support of my fellow post graduates and interns who have been a source of help in need. The most important part of any medical research is patients. I owe a great deal of gratitude to each and every one of them.

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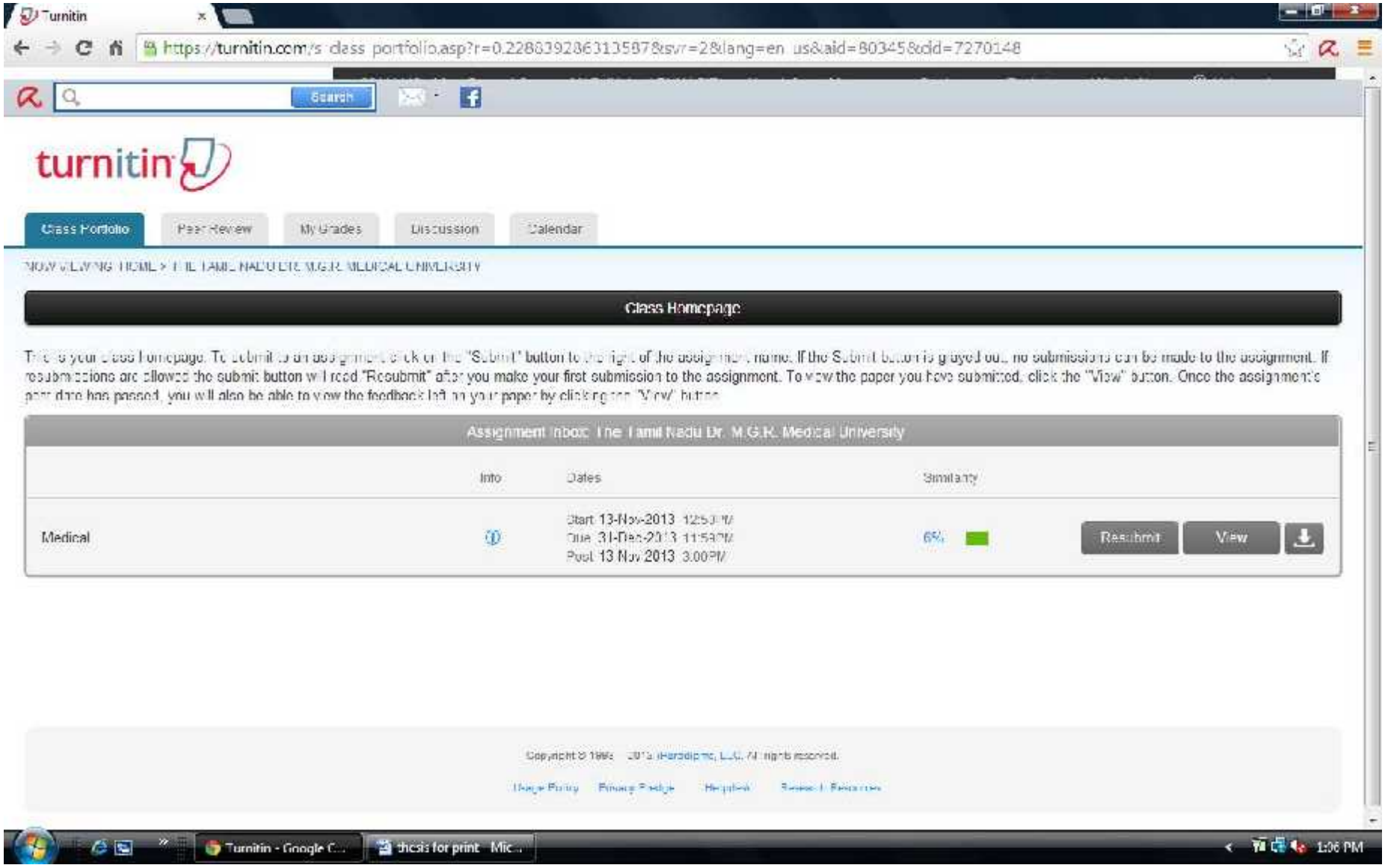
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AN OBSERVATIONAL STUDY OF PATIENTS UNDERGOING CONSERVATIVE VS SURGICAL MANAGEMENT FOR ADHESIVE SMALL BOWEL OBSTRUCTION

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INTRODUCTION

“An Observational study of patients undergoing Conservative Vs Surgical Management for Adhesive Small Bowel Obstruction’’

Abstract:

Adhesive small bowel obstruction is the common cause of small bowel obstruction. The common surgeries which lead to adhesion formation are pelvic surgeries. But the surgeries which are due to infective pathology like Acute Appendicitis, Acute Cholecystitis and Peritonitis due to Adhesion formation forms more adhesion than inflammatory causes.

In this study, the patients who underwent previous surgery were observed. Out of 100 patients who were observed, the primary objective is to analyze the specific symptom which is responsible for surgical management. Other data analyses like demographic analysis, analysis of previous surgery are also done.

In this study, when the patient is diagnosed to have Adhesive Small Bowel Obstruction, it is observed that fever has high sensitivity to subject the patient for surgical management. A hypothesis is developed from this observational study. Scoring system for the symptoms is assigned. The sensitivity and specificity for each of the symptoms to subject the patient for surgical management are measured and the accordingly score is assigned. The sensitivity of the scoring system is yet to be done in a big small size.

Keywords:

Adhesive Small Bowel Obstruction, ASBO, Seprafilm, Conservative management of ASBO, Surgical management of ASBO, Adhesiolysis

Introduction:

Adhesive small bowel obstruction accounts for more than 60 % of the Small Bowel Obstruction. [(1)] A breach in the peritoneum during any abdominal surgery will lead to adhesions. Adhesions can occur in 95 % to 100 % of patients who undergo abdominal surgery. But occurrence of Adhesive Small Bowel Obstruction is only in 1 to 10 % of the Appendicectomy, 6 % of Open Cholecystectomy, 10 to 25 % of the intestinal surgeries and 17 to 25 % of the Colorectal surgeries[(2)].

There are also other causes of Adhesive Small Bowel Obstruction apart from post operative causes like Tuberculous Abdomen, inflammatory Bowel Disorders, and malignancy. But these causes are far less compared to post operative Small Bowel Obstruction.

Adhesions are inevitable after Laparotomy. Inflammation and wound healing lead to fibrin formation and degradation. But this leads to adhesions. Many interventions are under trial to prevent formation of adhesions but the researchers make sure that the interventions do not interfere with the wound healing.

The management of the Adhesive small Bowel Obstruction is either Conservative or Surgical. The severity of the symptoms and signs varies in Small Bowel Obstruction, varies from patient to patient depending on the type of previous surgery the patient had undergone, the number of attempts and many other factors. In this study the symptoms and signs are analyzed in order to categorize the patient for conservative and surgical management.

REVIEW OF LITERATURE

Embryology:

Primitive gut is formed from the endoderm at fourth week of gestation. [3] The primitive gut forms the blind ending tubes in the cephalic and caudal end. The midgut stays outside the embryo with the Yolk sac and Allantois after cephalocaudal and lateral folding of the embryo. The epithelial lining of the gastrointestinal tract is formed by the endoderm and the muscles, connective tissue, peritoneal components etc are formed by the splanchnic mesoderm.

Relevant Gross Anatomy:

Small Bowel constitutes jejunum and ileum. The average length of the small intestine is 250cm to 260 cm (24 feet). The least length of the small intestine with which life is possible is 18 inches (45cm). About one third of the small bowel can be removed for survival without any complications. The length of the jejunum is 100cm to 110cm and the length of the ileum is 150 to 160cm.

The small intestine starts from ligament of Treitz which is a surgical landmark to identify the duodenojejunal flexure. There is no clear line of demarcation for differentiation of jejunum from ileum. Approximately

proximal two fifth forms the jejunum and the distal three fifth forms the ileum. Small intestine is suspended by the mesentery.

The mesentery is formed by the reflections of the peritoneum. The length of the mesentery is 6 inches or 15 cm. It starts at the Duodenojejunal flexure left of the L2 vertebra runs obliquely down to the right up to the right sacroiliac joint. The mesentery has Superior Mesenteric artery and its branches, lymph nodes, fat and autonomic nerve fibers. The root of mesentery crosses major vessels like abdominal aorta, Inferior vena cava, right gonadal vessels and viscera like third part of duodenum, right ureter and right psoas major muscle.

Operative features to differentiate jejunum and ileum: (Fig-5)

1. The wall of the jejunum is thick because of the valvulae conniventes. The valvulae conniventes are thick circular mucosal folds.
2. The diameter of the jejunum is more than the ileum.
3. Jejunum mostly occupies the umbilicus and the ileum occupies the suprapubic region.
4. Mesentery of the jejunum contains less fat than the ileum which consists of more fat.

5. The number of arcades is less in the jejunum and the Vasa recta are long and less frequent in number, but in the ileum it is vice versa.

Blood supply:

The small intestine is supplied by the artery of the midgut the Superior mesenteric artery and its branches the jejunal and ileal branch. These arteries branch to form the arcades and the Vasa recta, which help in identifying the jejunum and ileum. The venous drainage from the corresponding veins drain into the Superior Mesenteric Vein which along with Splenic Vein forms the Portal Vein.

Physiology:

The small intestine is delivered with around 9 liters of fluid per day from the salivary secretion which amounts to 1500ml per day, 2500ml of gastric juice per day, 500ml of bile, 1000ml of pancreatic juice, the intestinal secretion of 1000ml and the daily intake of 2 to 3 liters. But only 2 liters are delivered to the colon the rest of about 7 liters are reabsorbed. The extensive absorption capacity of the small intestine is due to the presence of Villi, valvulae conniventes, microvilli which increase the surface area by 600 folds. The peristalsis is illustrated in the Fig-8.

Adhesive Small Bowel Obstruction (ABSO):

Adhesive Small bowel obstruction is one of the common abdominal emergencies which are dealt by the General Surgeons. Intact and Well vascularised Peritoneum prevents adhesion formation. Once the bowel is out of the abdominal cavity there are 95 % to 100% chances of adhesion formation. Even though mortality is uncommon there are significant morbidity and hospital admissions due to Small bowel Obstruction.

The search is on for a perfect adhesive Barrier. The solution for prevention of adhesions after Laparotomy is still elusive. There is no perfect guideline to avoid adhesions during Laparotomy yet. [(4)] There are extensive ongoing trials to classify the adhesion severity and for development of management protocol.

History:

350 B.C. - Hippocrates:

Before 350 B.C., Hippocrates was the one who first said about intestinal obstruction. He made a detailed description of the intestinal obstruction which is clear from his words "In ileus, the belly becomes hard, there are no motions; the whole abdomen is painful, there are fever and thirst and sometimes the patient is so tormented that he vomits bile."

16th century-Sanctus:

Then Sanctus in the 16th century was the one who treated intestinal obstruction using mercury. He used mercury as it is a heavy metal which helped him to open up the obstructed intestine.

17th century- Sydenham and Le Peyrone:

In 17th century Sydenham and Le Peyrone worked on intestinal obstruction. Nelaton was the first person to decompress the dilated bowel due to intestinal obstruction. He did enterostomy of the proximal bowel loop.

19th Century and 20th Century:

Billroth was the first person to do a bypass anastomosis for intestinal obstruction by the year 1881. Treves in the year 1899, won the Jacksonian prize from the Royal college of Surgeons for his operative management of the intestinal obstruction.

In 1919, Kloiber described the level of intestinal obstruction using X-Ray and he published a paper regarding this. In the year 1932, Wagensteen treated intestinal obstruction using fluid replacement, enterostomy.

21st Century:

A recent advance in the adhesion barrier is invention of Seprafilm-sodium hyaluronate-carboxymethylcellulose (HA-CMC) barrier. The company claims that it reduces adhesion by 93%. [5]

History of Adhesion Barrier:

Year	Methods used
1885	Rubbing oil used to prevent adhesions
1892	Fibrinolysin (sodium salicylate and thiosinamine) marketed
1902	Gum Arabic used as visceral lubricant
1905	Cargile (bovine Cecal peritoneum) introduced
1920	Intra abdominal proteases described
1940	Heparin first studied
1957	Amfetin (amniotic Fluid) marketed
1994	Seprafilm studied in prospective study

Definition of Adhesion:

Peritoneal Adhesions are pathological bands between the loops of the Bowel, Bowel and abdominal wall, between bowel and omentum, between omentum and abdominal wall. [6]

Etiology of the Adhesions:

The Adhesions are broadly classified as

1. Congenital
2. Acquired.

Congenital adhesions are anomalies found from birth. They are Vitello intestinal bands, adhesions in the lesser sac.

Ladd's band:

Ladd's band is the fibrous stalk which connects cecum to the abdominal wall and it causes malrotation and volvulus in the pediatric age group. Ladd was the one who first described it and the procedure done is called Ladd's Procedure which includes appendicectomy, release of the band, lengthening of the mesentery with Caecopexy.

Acquired Adhesions:

Acquired Adhesions are due to inflammatory or after previous abdominal surgery. [7] Post operative adhesions are commonest of all types of adhesion.

Generally intra peritoneal adhesions are due to

1. Ischemic area
2. Infections
3. Presence of foreign bodies
4. Inflammatory disease
5. Radiation enteritis.

Post inflammatory adhesions are due to Appendicitis, Diverticulitis, pancreatitis, Cholecystitis, Pelvic Inflammatory Disease, and Abdominal Tuberculosis. (Fig-17, Fig 18, Fig-19)

Post operative adhesions are usually due to trauma due to

1. Suturing
2. Use of cautery – thermal injury
3. Infections
4. Foreign bodies.

Tight suturing lead to serosal damage and ischemia. Use of glove powders, talc in the gloves, lint used in abdominal packs, reactive suture materials like silk are few other causes of the post operative adhesion formation. Hot saline peritoneal wash also causes post operative adhesion formation [8]. All these substances form a peritoneal foreign body granuloma. This is proved by histopathological examination of adhesive tissues which have shown glove powder, suture materials. When examined under microscope Starch Granuloma shows starch which comes with gloves.

Classification of Adhesions:

The Adhesions are classified as follows by the Diamond et al

1. Type- 1 adhesions are de novo adhesion formation in which the adhesions are formed where there is no previous adhesion formation.
    a. Type-1A- where the adhesions are formed without a previous surgery
    b. Type-1B- where the adhesions are formed when a previous surgery is done.
2. Type-2 where there is adhesion reformation
    a. Type-2A- no operative procedure except for Adhesiolysis
    b. Type-2B- operative procedures done at the site of adhesion formation

These classifications do not alter the management of the adhesions. But they give an idea regarding the future management strategies.

Peritoneal Adhesion Index:

Peritoneal adhesions are scored and the severity index is given by Coccolini et al. He divided abdomen into nine regions with alphabets A-I where adhesions are formed and the tenth region is bowel to bowel adhesion with alphabet L. The severity of the adhesions are graded from 0- 3. [9]

Adhesions scoring grade are as follows

1. 0- No Adhesions
2. 1- flimsy adhesions which needs blunt dissection (Fig-20)
3. 2- sharp adhesions which need sharp dissection (Fig-21)
4. 3- vascularised adhesions which needs sharp dissection and can lead to inadvertent enterotomies.

Pathophysiology of the adhesion formation:

Pathophysiology of the adhesion formation is complex. For the past 20 years, the researchers have come out with few accepted concepts in the pathogenesis of the adhesion formation at cellular level. Macrophages, proteases, coagulation factors and cytokines help in regaining tissue integrity but often with adhesion formation. Understanding the pathogenesis helps in prevention of the adhesion formation and molecular level management of the adhesions.

Peritoneum is made of mesothelium which is attached to the basement membrane. The submesothelial layer consists of extracellular matrix, capillaries and lymphatic. The peritoneal fluid consists of cells which secretes the cellular mediators that helps in wound healing. When there is a peritoneal injury there is an exudate.

The exudate is rich in fibrinogen and other plasma proteins. Apart from exudate there is bleeding which results in activation of the coagulation cascade. This forms the thrombin converting the fibrinogen to fibrin. [(10)] This fibrin formation is temporary which undergoes fibrinolysis within 72 hours. The fibrin formed can be degraded by Matrix Metalloprotease (MMP) and the process is called fibrinolysis. Usually mesothelium gets activated

due to fibrinolysis and proliferation occurs covering the peritoneum within four days. If the fibrinolysis does not occur then the fibrin stimulates fibroblast formation and secretion of collagen. This collagen matures to form bands and adhesions. Due to the presence of angiogenic factors, the mature adhesions develop arterioles, venules, capillaries and nerve fibres in addition to the collagen. [11] Fig-10.

As the fibrinolysis is activated the plasminogen activators tPA, uPA are also activated. tPA (tissue plasminogen activator) which is secreted by the mesothelium enhances the fibrinolysis whereas the uPA (urokinase type tissue plasminogen activator) helps more in tissue remodeling rather than fibrinolysis. [12]

There are two plasminogen activator inhibitor- PAI- 1 and PAI-2. PAI-1 is a more potent inhibitor than PAI-2. PAI-1 is seen more in the adhesions. [13, 14]

In the post operative patient there is decreased blood supply and decreased oxygenation which leads to poor fibrinolysis leading on to adhesion formation. [15]

Pathophysiology of the strangulated Adhesive Small bowel Obstruction:

9 liters of fluid pass through small intestine per day. Adhesive obstruction causes stasis of the content delivered to the small intestine. This causes dilatation of the proximal bowel loops. As there is mucosal disruption due to distention of the loops attracts the neutrophils and the cascade of inflammatory reaction. This leads to increased vasodilatation leading on to third space loss which eventually ends up in dehydration. (Fig-11)

As there is increase in intraluminal pressure there is a subsequent vascular compromise. The vascular compromise starts at an intraluminal pressure of 30mm of mercury at which the capillary circulation is disrupted; at an intra luminal pressure of 60mm of mercury the blood flow stops.

Poor blood flow to the intestinal mucosa causes mucosal disruption leading to transmigration of the micro organism leading to sepsis. This is the cause for endotoxic shock. So, before the patient is posted for surgical procedure, preoperative antibiotic is essential.

The systemic effects of intestinal obstruction are due to vomiting and third space loss. There is dehydration and electrolyte imbalance in the form

of hyponatremia, hypokalemia. Aldosterone secretion in response to hypovolumia worsens the electrolyte imbalance.

Abdominal cocoon: (Fig-16)

It is a rare condition in which the small bowel is encapsulated by fibrocollagenous membrane causing small bowel obstruction. [16] It is more common in females. It is an intra operative finding. Cocoon can be idiopathic or secondary to some cause. The causes of abdominal cocoon are abdominal tuberculosis, use of povidone iodine for abdominal wash, subclinical peritonitis.

Clinically even though there is small bowel obstruction there will not be abdominal distention as the small bowel are encased. No investigation is reliable in diagnosing abdominal cocoon. CT scan and MRI abdomen can be helpful.

Presentations of Adhesive Small Bowel Obstruction:

1. Type of onset:
    a. Acute
    b. Subacute
    c. Acute on chronic
    d. Chronic
2. Type of obstruction:
    a. Partial obstruction
    b. Complete obstruction
3. Presence of ischemia:
    a. Simple
    b. Strangulated
4. Site of obstruction:
    a. High small bowel obstruction (proximal)
    b. Low small bowel obstruction (distal)

5. Depending on the loops
    a. Open loop obstruction
    b. Closed loop obstruction

Symptoms of the Adhesive small Bowel Obstruction:

The most common symptoms of the intestinal obstruction are

1. Intestinal colic
2. Vomiting
3. Distension
4. Fever
5. Constipation or Obstipation

Intestinal colic:

If the obstruction is high in the jejunum, the colic occurs very frequently for every 3-5 minutes. Usually the abdominal colic lasts for 30 minutes. If there is ileal obstruction the frequency of the abdominal pain decreases to every 8-10 minutes. As the small bowel is supplied by T 9, T 10, T11 segments the site of the abdominal colicky pain is usually the umbilical

region and epigastrium. But the colonic pain is usually radiates to hypogastrium.

Vomiting is a constant symptom. Jejunal obstruction presents with vomiting frequently rather than the ileal obstruction. In the initial episodes of vomiting, the gastric contents are expelled, followed by the duodenal content which has bile. If the obstruction continues the feculent small intestinal contents are expelled in the vomitus which is usually an ominous sign.

Distention is a late sign of small bowel obstruction. If it is picked up in the early stage it may be of very helpful. Serial measurement of the abdominal girth helps early diagnosis. If the increase of abdominal girth is rapid, intervention is needed.

Other symptoms of obstruction are absolute constipation or obstipation and dehydration. Absolute constipation will occur in the late stage. The patient may pass stools and flatus in spite of obstruction as the bowel distal to obstruction will have peristalsis. For absolute constipation to occur one has to wait for 24 hours to rely on this symptom.

Diarrhea can occur in intestinal obstruction in

1. Richter's hernia
2. Mesenteric vascular obstruction
3. Pelvic abscess.
4. Partial Obstruction
5. Gall stone Ileus

Fever is a symptom which is ominous when the patient has adhesive small bowel obstruction. Presence of fever in these patients can be due to electrolyte imbalance, bowel gangrene, and peritonitis. When there is a high grade fever the obstruction is usually associated with peritonitis or bowel gangrene.

Physical examination:

Depending on the type of obstruction and site of obstruction the patient becomes dehydrated. Signs of dehydration like sunken eyes, dry mouth, and loss of skin turgor occur (Hippocratic faces).

Fever is a feature of bowel ischemia, peritonitis, infection.

Signs:

The abdominal distention occurs in late stage in distal bowel obstruction. If the individuals are thin the visible intestinal peristalsis is visualized.

Scar due to previous surgery is present in cases of adhesive obstruction. (Fig-12) (Fig-13)

The various sites of the scars will help in identifying the type of previous surgery performed.

The abdomen is soft until the peritonitis sets in. There can be localized guarding or generalized rigidity depending on the complication. Signs of peritonitis are indications for surgical management. Initial presentation will have increased peristalsis leading to excessive bowel sounds heard. This excessive bowel sounds are heard as tinkling high pitched sounds called as Borborygmi sounds. As the bowel get exhausted due to excessive peristalsis there will be absent bowel sounds usually called as ‘silent abdomen’.

Per rectal examination may reveal blood stained stool or empty if the obstruction is more than 24 hours.

Per vaginal examination is a must to rule out pelvic inflammatory disease. Chandelier sign (stimulation of the cervix causes pain in the right Iliac fossa) is positive in case of pelvic inflammatory disease.

Laboratory investigation:

When sepsis sets in, the Polymorph counts increase. In general there will be electrolyte disturbances due to third space loss. Due to dehydration there is a possibility of renal shutdown leading on to acute renal failure with elevated BUN and urine specific gravity. If the acidosis sets in it is a grave sign. In 71% of the patients the creatinine kinase increases in strangulated obstruction.

The electrolytes and biochemical disturbances which can occur are

1. Hyponatremia,
2. Hypokalemia,
3. Metabolic acidosis
4. Hypochloremia
5. Uremia

Difference between Proximal and Distal Adhesive small bowel obstruction

S.No	Characters	High bowel obstruction	Low small bowel obstruction
1.	Onset of Symptoms	Sudden	Slow
2.	Pain characteristics	Severe, epigastric colicky pain relieved by vomiting	Periumblical colicky pain
3.	Vomitus	Frequent large volume vomitus	Less frequent low volume with progression to feculent vomitus
4.	Tenderness	Epigastric or periumblical	Diffuse
5.	Distension	Frequently absent	Diffuse and progressive
6.	Obstipation	May or may not be present	Mild or moderate
7.	X-Ray Findings	Abdomen is usually gasless or show distended proximal small bowel	Dilated bowel loops with air fluid column in erect posture

Radiological investigation:

X-ray Abdomen:

It has sensitivity of only 50-60% [17] and 10 % of the x-rays are misleading. The drawback of X-Ray abdomen erect is due to non specific bowel gas shadow. (Fig-14, Fig-15)

A normal small bowel gas pattern is up to four air fluid level with bowel size less than 2.5 cm in all the loops with gas and feces in the colon. An abnormal gas pattern is at least three fluid levels with one loop greater than 3 cm with normal or partially distended colon. This is suggestive of partial or low grade small bowel obstruction. Probable small bowel obstruction is multiple air fluid level with partial gas in the colon or absence of gas in the colon. Dilated small bowel with multiple air fluid level with absent colonic gas shadow is a characteristic feature of the complete small bowel obstruction. [18]

Characteristics of the bowel in X-Ray abdomen erect

1. Jejunum- presence of valvulae conniventes with ladder effect
2. Ileum- featureless (Wangensteen)

3. Cecum- rounded gas shadow in right iliac fossa

4. Large bowel- Haustral folds

Computed tomography:

The sensitivity of the CT abdomen in detecting low grade small bowel obstruction is 60% and for the high grade obstruction it is 95%. The contrasts if at all used are either 1.2% barium or 2% solution of iodinated water soluble contrast. In the era of Multi Detector Computed Tomography oral contrast is avoided. Oral contrast increases vomiting and worsens the condition and it is contra indicated in bowel ischemia. CT with intravenous contrast is the most helpful imaging procedure. The advantage of MDCT is reconstruction which provides option of instantaneous multiplanar reconstruction.

CT Abdomen differentiates Adhesive small bowel obstruction from a Paralytic Ileus. In CT the transition point can be made out in case of the Small bowel Obstruction which is absent in the Paralytic Ileus. More over in adynamic obstruction colonic distension is more than small bowel distention.

The findings of a strangulated bowel obstruction in CT abdomen are

1. Wall thickening
2. Target or Halo appearance due to submucosal edema
3. Mesenteric vessel engorgement or blurring in severe cases
4. Simple Ascites or hemorrhagic in severe cases
5. Pneumatosis
6. Pseudotumour sign- the ischemic bowel appear as a soft tissue mass
7. Mesenteric or portal venous gas.

The accuracy of MDCT abdomen is 95 % in diagnosing the ischemia due to small bowel obstruction.

CT Enteroclysis:

It has very high sensitivity of 95%. It is very advantageous in low grade small bowel obstruction. It is lesser operator dependent so the results are uniform. [19] The characteristics and site of adhesion in adhesive small bowel obstruction is made out by Computed Tomography with enteroclysis especially in partial small bowel obstruction.

Gastrografin study in adhesive small bowel obstruction:

Gastrografin is the trade name of Diatrizoic acid in the form of Sodium Diatrizoate and Meglumine Diatrizoate. It also contains a wetting agent called Polysorbate 80. It is a contrast media used in the radiology for many contrast investigations. It is a hypertonic solution with osmolality of 1500 mOsm/kg which is 50% Gastrografin to 2000 mOsm/kg which is 76% Gastrografin. It is used in the bowel imaging. It is either used orally or as an enema.

In adhesive small bowel obstruction if the conservative management is not helpful, when the patient has no signs of peritonitis, Gastrografin is used safely. Gastrografin study helps in relieving the obstruction in addition to the imaging study. It dilutes the bowel content and polysorbate 80 makes the bowel content to pass through the narrowed obstructed lumen. The edema of the bowel wall is also decreased and therefore the motility increases. [(20)] Barium is not used in the place of Gastrografin as it causes perforation and peritonitis sets in. Moreover barium can stick to bowel making the obstruction severe.

Management of adhesive small bowel obstruction:

In small bowel obstruction the management includes

1. Resuscitation
2. Rehydration
3. Correction of electrolyte imbalance
4. Stabilization of vitals
5. Correction of metabolic disturbances like correction of metabolic acidosis.
6. Intestinal decompression using naso-gastric tube.

The major strategy in management include

1. the identification of Obstruction
2. Type of obstruction partial or complete
3. Identification of strangulation

Resuscitation:

Resuscitation includes the volume replacement which is lost in the third space. The volume of replacement cannot be measured. But the urinary

output can give an approximate estimation of third space fluid loss. In strangulated obstruction the Swan Ganz catheter is helpful in measuring the pulmonary wedge pressure, cardiac output and mixed venous oxygen saturation. It takes 24 hours to correct hypokalemia.

Choice of IV fluid:

Usually ringer Lactate or Normal Saline is the fluid of choice in patients with third space fluid loss. The fluid is rushed till the urinary out is maintained at 1ml/kg of body weight/day. If there is an excessive gastric fluid loss just 0.9% normal saline is sufficient to resuscitate. Intravascular fluid loss is replaced by crystalloids. If there is a blood loss due to hemorrhagic infarct in gangrene bowel, whole blood is transfused. Always the rule is blood for blood is followed in small bowel obstruction.

Placement of Nasogastric tube:

Nasogastric tube helps in

1. Stomach decompression
2. Intestinal decompression by aspiration of contents
3. Decreasing the risk of aspiration due to stasis and secretion

Urinary catheter is placed to monitor the urinary output throughout the resuscitation which is a vital parameter.

Antibiotics:

Antibiotic is a must in all cases of adhesive small bowel obstruction. In simple obstruction there is a chance of transmigration of the bacteria and their toxins which needs to be neutralized by antibiotics. In strangulated obstruction there is peritonitis which leads to sepsis.

Conservative management of Small Bowel Obstruction:

The conservative management includes

1. Intestinal decompression using Nasogastric tube or Bakers tube
2. Nothing by mouth to a maximum of 72 hours
3. Broad spectrum antibiotics
4. Fluid resuscitation
5. Urinary output monitoring
6. Maintenance of electrolytes and renal parameters.

Surgical management of the Adhesive small Bowel obstruction:

The surgical management includes

1. Laparoscopic Adhesiolysis
2. Open Adhesiolysis

Laparoscopic Adhesiolysis:

This is the preferred method of Adhesiolysis now a days as this has less peritoneal damage. Conversion to open Adhesiolysis is due to difficult visualization.

Technique: (Fig-23)

First trocar is placed 5-10 cm away from the previous scar. Usually the trocars are placed under vision using Hassons open technique. Two other working ports are placed in triangulation and sufficient working space is obtained. When distended bowel is noticed caution is necessary. Additional trocars can be placed in difficult situation. Dissection is started from virgin area and in avascular planes. All flimsy and band adhesions are lysed.

Indications for laparoscopic Adhesiolysis:

1. Partial or complete small bowel obstruction

2. Absence of bowel perforation
3. Absence of peritonitis
4. Chronic small bowel obstruction

Contraindications:

1. Poor surgical skills
2. Hemodynamic instability
3. Abdominal distention that precludes working space
4. Patients intolerable to pneumoperitoneum
5. Peritonitis and perforation.

Complications of Adhesiolysis:

1. The serious complication is recurrence due to serosal damage (Fig-22)
2. Inadvertent enterostomy
3. Injury to vitals structures like bladder, ureter, gall bladder, major blood vessels
4. Band formation with entero enteric fistula formation.

Open Adhesiolysis:

Any Adhesiolysis is a high risk factor for recurrent adhesion. Most of the adhesive small bowel obstruction is managed conservatively. Open Adhesiolysis is not preferred in this era of laparoscopy. In open Adhesiolysis there are increased chances of peritoneal damage which is a risk factor for adhesion formation.

Open Adhesiolysis is done is two different way

1. Blunt dissection in flimsy adhesions
2. Sharp dissections in bands and mature adhesions

Indications:

1. Strangulated adhesive small bowel obstruction
2. Adhesive Small Bowel Obstruction with features of peritonitis
3. Complete adhesive small bowel obstruction.

Technique:

Always Laparotomy is preferred from a virgin area. For example if there is a upper midline incision go from lower midline incision. Thorough Laparotomy is done. Sharp dissection is preferred for Adhesiolysis. It is

better to err on the peritoneal side than to err on the serosal side while doing sharp dissection. The bands are clamped, cut and ligated. Inadvertent enterotomy is closed using vicryl. When ischemic bowel is come across limited resection is done. Either resected bowel is anastomosed primarily or brought out as enterostomy depending on the situation.

The use of adhesive barriers is promoted. But there are both advantage and disadvantage.

Prevention of adhesions:

There are various agents used in the prevention of adhesions but none give good results. As of now Seprafilm is widely used in prevention of adhesions in many surgical procedures. Laparotomy is inevitable in emergency settings.

The aim of the adhesion prevention is to decrease the severity and morbidity but retain the normal healing process. Adhesion can be prevented by following measures [21]

1. Early Laparotomy is better than delayed Laparotomy. Delayed Laparotomy will lead on to various complications like severe adhesion formation due to generalized peritonitis.

2. Avoiding foreign materials inside the peritoneum.

3. Before Laparotomy the starched gloves are washed

4. Small appropriate Sutures materials are used in appropriate tension.

5. Careful tissue handling and retraction

6. Electro cautery usage is minimized

7. Perfect hemostasis required

8. Avoiding desiccation and ischemia

9. Thorough wash after Laparotomy with Luke warm saline.

The six strategies to prevent adhesion formation are

1. decrease the peritoneal damage

2. decrease the inflammatory reactions

3. prevent fibrin formation

4. increase the fibrinolysis

5. prevention of collagen formation

6. barriers to adhesion formation

S.No	Mechanism	Strategies
1.	decrease the peritoneal damage	• Laparoscopic approach [22] • Meticulous approach • 32% dextran 70 • Povidone
2.	decrease the inflammatory reactions	• Heparin • Adenosine [23]
3.	prevent fibrin formation	• Corticosteroids • Non steroidal anti inflammatory[24] • Pentoxyphylline • Calcium channel blockers • Vitamin E
4.	increase the fibrinolysis	• Streptokinase • Urokinase • Recombinant tissue plasminogen activator (rtPA)
5.	prevention of collagen formation	• Halofuginone
6.	barriers to adhesion formation	• 32% dextran 70 • Silicone • Amniotic membrane [25] • Modified oxidized regenerated cellulose(interceed) • Expanded poly tetrafluro ethylene • Hyaluranon based membranes(Seprafilm) [26] • Poly lactide co glycolide (PLGA) • Poly lactic acid film (surgiwrap)

Management of Strangulated Adhesive Small Bowel Obstruction:

The strangulated segment of the obstructed bowel are usually resected and anastomosed. When there is extensive bowel resected there are more chances of short Bowel Syndrome.

Sometimes obstruction is bypassed. This can lead to Blind Loop Syndrome.

When there is diffuse peritonitis the small bowel is exteriorized either as loop enterostomy or end enterostomy.

Short Bowel Syndrome:

When there is excessive resection of the Small bowel, which is less than 200cm leads to Short Bowel Syndrome. Short Bowel Syndrome is clinically characterized by malabsorption, diarrhea, steatorrhea, fluid and electrolyte disturbances, and malnutrition.

Blind Loop Syndrome:

Blind loop syndrome occurs when part of the small intestine becomes bypassed. The "blind loop" formed by the bypassed intestine means food can't move normally through the digestive tract. The slowly moving food

and waste products become a breeding ground for bacteria, which can lead to a condition called bacterial overgrowth. As a result, nutrients may not be fully absorbed. Blind loop syndrome often causes diarrhea and may cause weight loss and malnutrition.

Treatment of recurrent Adhesions:

1. Repeat Adhesiolysis (enterolysis) alone
2. Noble's plication operation
3. Charles–Phillips transmesenteric plication
4. Intestinal intubation (Miller–Abbott intestinal tube)

Noble's Plication Operation:

Intestine-to-intestine suturing is performed to prevent re-obstruction of the bowel. This procedure prevents not only passage disturbance resulting from kinking and adhesion of the small intestine, but also escape of the bowel into the pelvic cavity and formation of further adhesions. Usually, the entire small intestine is fixed between the mesenteric and antimesenteric borders from the ileum end proximally.

OBJECTIVE

Objective of the study:

1. The Primary Objective of this study is observation and comparison of symptoms with the type of management in the same cohort of patients with previous surgery.
2. The secondary objectives of this study are
    a. Demographic analysis of the cohort
    b. To analyse the symptoms of the patients suffering from small bowel obstruction
    c. To analyze the indication for previous surgery the patient has undergone.
3. Develop a hypothesis and scoring system for the symptoms for adhesive small bowel obstruction.

MATERIALS AND METHODS

Inclusion criteria:

1. Patients who have symptoms of abdominal pain, abdominal distension, vomiting, fever, constipation or obstipation are chosen
2. Abdominal X-Ray must show either dilated bowel loop or Multiple air fluid level are chosen.
3. Both male and female patients are chosen for the study
4. Patients who have undergone previous surgery were chosen.
5. Patients age must be 18 years – 75 years
6. Mentally sound patient who gives previous surgical history was chosen.
7. Patients with repeated episodes of abdominal pain with hospital admissions after intra abdominal or pelvic surgeries have been chosen.

Exclusion criteria:

1. Patients who have undergone surgery for intra abdominal malignancy were excluded.
2. Patients whose age was less than 18 and greater than 75 were excluded.
3. Pregnant women were excluded.

STUDY METHODOLOGY

STUDY METHODOLOGY:

An observational study was conducted of patients from the Department of General Surgery, Department of Surgical Gastroenterology, Department of Obstetrics and Gynecology, Kilpauk medical college and Government Royapettah Hospital. The study period was from September 2012 to November 2013. A cohort of patients who attend the departments with symptoms suggestive of adhesive small bowel obstruction with previous history of surgery was chosen in the study period. The patients with the symptoms of abdominal pain, vomiting, fever, abdominal distension and constipation or obstipation were chosen.

100 patients who came with symptoms suggestive of Small Bowel Obstruction due to previous surgery were observed. Patients underwent detailed clinical examination and investigation after obtaining consent. When Adhesive small bowel obstruction was identified the details of management was recorded. The primary observation was whether the presenting symptoms determined the type of management and whether specific symptom which led to surgical intervention could be identified.

The secondary observations which were observed in this study were as follows

1. Demographic analysis
2. Type of previous surgery
3. Analysis of Number of previous similar episodes
4. Days taken for the relief of symptoms in conservative management
5. Type of operative procedure either open Adhesiolysis or laparoscopic Adhesiolysis.

DATA COLLECTION:

The data of the patients who attended the Department of General Surgery, Surgical Gastroenterology, Department of Obstetrics and gynecology in Kilpauk Medical College and Government Royapettah Hospital were collected from the respective department while on admission. The patient who was discharged in due course of the observation was collected from the Medical Records Department. Few data of the patients were collected exclusively from the Medical records departments.

A standard proforma was used to record all the data collected. The proforma included data like age, sex, presenting complaints. The past history of previous surgery and the indication for the abdominal surgery was recorded. The clinical examinations were included in the proforma but the abdominal signs like abdominal tenderness, guarding and rigidity were given importance and recorded. In Abdominal X Ray, dilated bowel loops or multiple air fluid level was given importance and recorded. The treatment details like conservative or surgical management was finally recorded. The number of days of conservative management followed with or without surgical management was given importance for analysis.

PROFORMA

1. PATIENT NAME AGE SEX IP NUMBER
2. DEPARTMENT HOSPITAL
3. CHIEF COMPLAINT
    - ABDOMINALPAIN
    - VOMITING
    - ABDOMINAL DISTENTION
    - FEVER
    - CONSTIPATION/OBSTIPATION
4. PAST SURGICAL HISTORY

❖ INDICATION FOR SURGERY

5. GENERAL EXAMINATION, VITALS, BLOOD PRESSURE, RESPIRATORY RATE, TEMPERATURE
6. ABDOMINAL EXAMINATION
7. INVESTIGATIONS
    - ❖ ABDOMINAL ERECT X RAY
8. TREATMENT
    A. CONSERVATIVE - TIME OF RESOLUTION OF SYMPTOMS
9. SURGICAL TREATMENT
    A. OPEN
    B. LAPAROSCOPIC

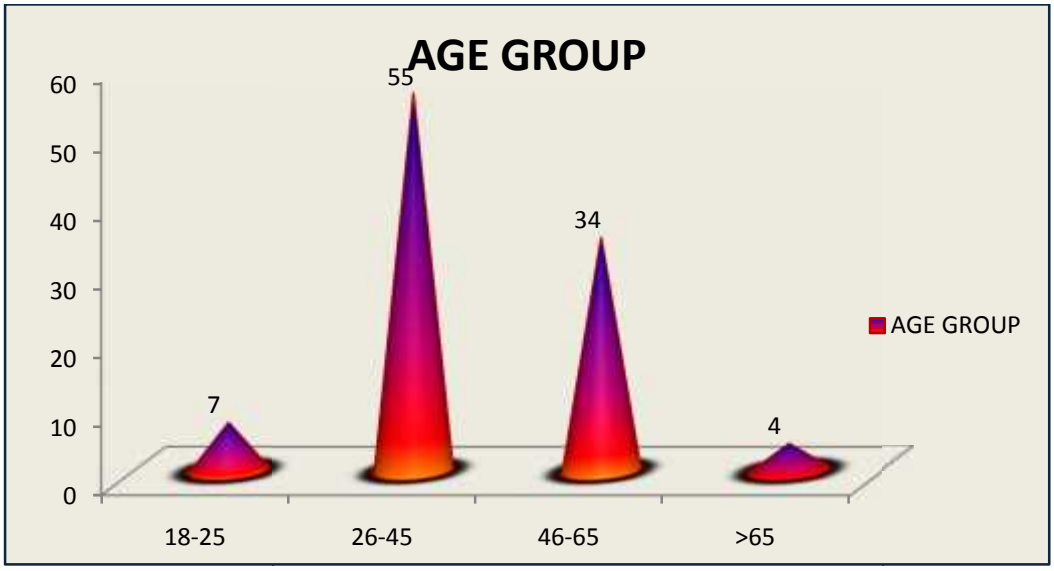
DATA ANALYSIS

DATA ANALYSIS

DEMOGRAPHICS

AGE DISTRIBUTION OF PATIENTS IN THE STUDY:

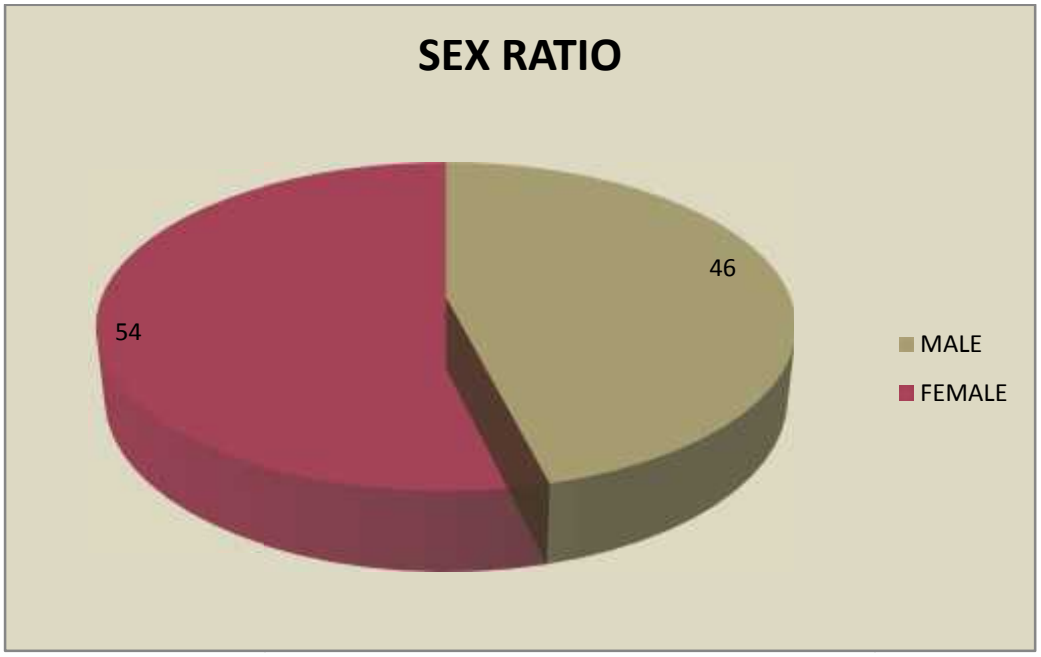
Chart-1



AGE GROUP	%AGE
18-25	7
26-45	55
46-65	34
>65	4

SEX DISTRIBUTION:

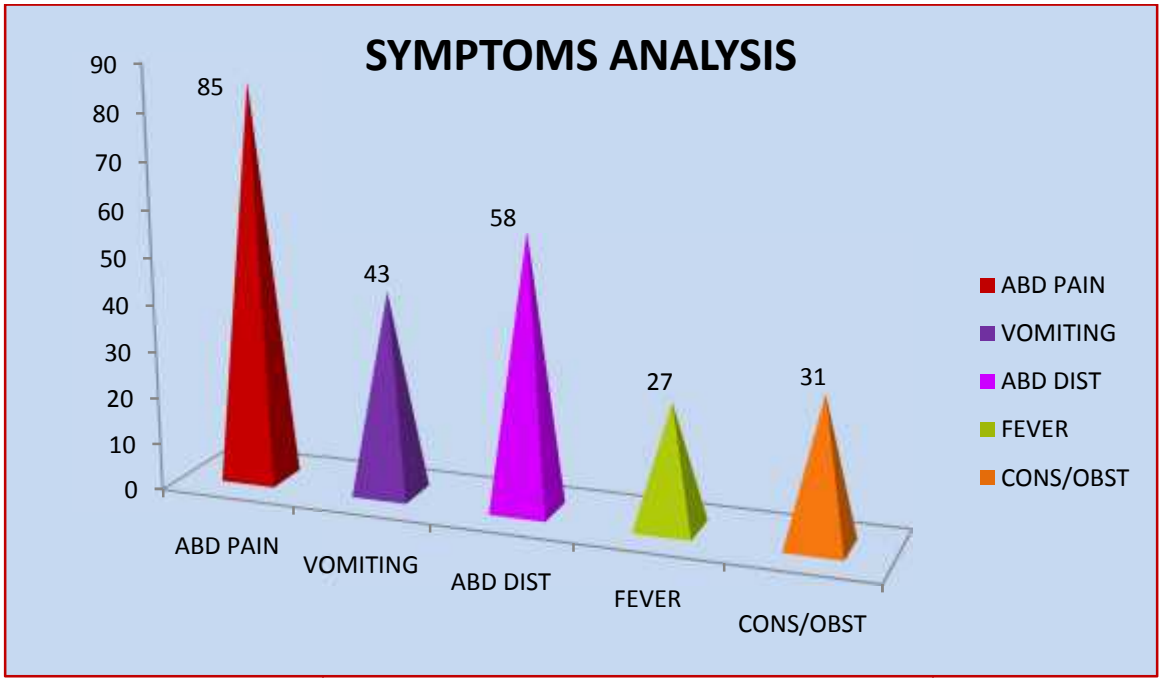
CHART-2



SEX	%AGE
MALE	**46**
FEMALE	**54**

SYMPTOMS ANALYSIS:

CHART-3



SYMPTOMS	NUMBER OF PATIENTS
ABDOMINAL PAIN	***85***
VOMITING	***43***
ABDOMINAL DISTENTION	***58***
FEVER	***27***
CONSTIPATION/OBSTIPATION	***31***

Symptom Analysis:

All the symptoms were analyzed for sensitivity and specificity regarding the management of patients whether continuation of conservative management or early surgical intervention.

Significance of abdominal pain in management:

	Abdominal pain positive	Abdominal pain negative
Surgical	27	0
conservative	58	15

Sensitivity	$\frac{a}{a+b}$	= 31.76 %	95% CI: 22.09 % to 42.76 %
Specificity	$\frac{d}{c+d}$	= 100.00 %	95% CI: 78.03 % to 100.00 %
Positive Likelihood Ratio	$\frac{\text{Sensitivity}}{100 - \text{Specificity}}$		
Negative Likelihood Ratio	$\frac{100 - \text{Sensitivity}}{\text{Specificity}}$	= 0.68	95% CI: 0.59 to 0.79
Disease prevalence	$\frac{a+b}{a+b+c+d}$	= 85.00 % (*)	95% CI: 76.47 % to 91.35 %
Positive Predictive Value	$\frac{a}{a+c}$	= 100.00 % (*)	95% CI: 87.11 % to 100.00 %
Negative Predictive Value	$\frac{d}{b+d}$	= 20.55 % (*)	95% CI: 11.99 % to 31.62 %

Significance of vomiting in management:

	Vomiting positive	Vomiting negative
Surgical	18	9
conservative	25	55

Sensitivity	$\frac{a}{a+b}$	= 41.86 %	95% CI: 27.02 % to 57.87 %
Specificity	$\frac{d}{c+d}$	= 85.94 %	95% CI: 74.97 % to 93.35 %
Positive Likelihood Ratio	$\frac{\text{Sensitivity}}{100 - \text{Specificity}}$	= 2.98	95% CI: 1.48 to 6.00
Negative Likelihood Ratio	$\frac{100 - \text{Sensitivity}}{\text{Specificity}}$	= 0.68	95% CI: 0.52 to 0.89
Disease prevalence	$\frac{a+b}{a+b+c+d}$	= 40.19 % (*)	95% CI: 30.82 % to 50.11 %
Positive Predictive Value	$\frac{a}{a+c}$	= 66.67 % (*)	95% CI: 46.04 % to 83.45 %
Negative Predictive Value	$\frac{d}{b+d}$	= 68.75 % (*)	95% CI: 57.41 % to 78.65 %

Significance of abdominal distention in management:

	Abdominal distention positive	Abdominal distension negative
Surgical	22	5
Conservative	36	49

Sensitivity	$\frac{a}{a+b}$	= 37.93 %	95% CI: 25.52 % to 51.63 %
Specificity	$\frac{d}{c+d}$	= 90.74 %	95% CI: 79.69 % to 96.89 %
Positive Likelihood Ratio	$\frac{\text{Sensitivity}}{100 - \text{Specificity}}$	= 4.10	95% CI: 1.67 to 10.05
Negative Likelihood Ratio	$\frac{100 - \text{Sensitivity}}{\text{Specificity}}$	= 0.68	95% CI: 0.55 to 0.85
Disease prevalence	$\frac{c+b}{a+b+c+d}$	= 51.79 % (*)	95% CI: 42.15 % to 61.33 %
Positive Predictive Value	$\frac{a}{a+c}$	= 81.48 % (*)	95% CI: 61.90 % to 93.63 %
Negative Predictive Value	$\frac{d}{b+d}$	= 57.65 % (*)	95% CI: 46.45 % to 68.30 %

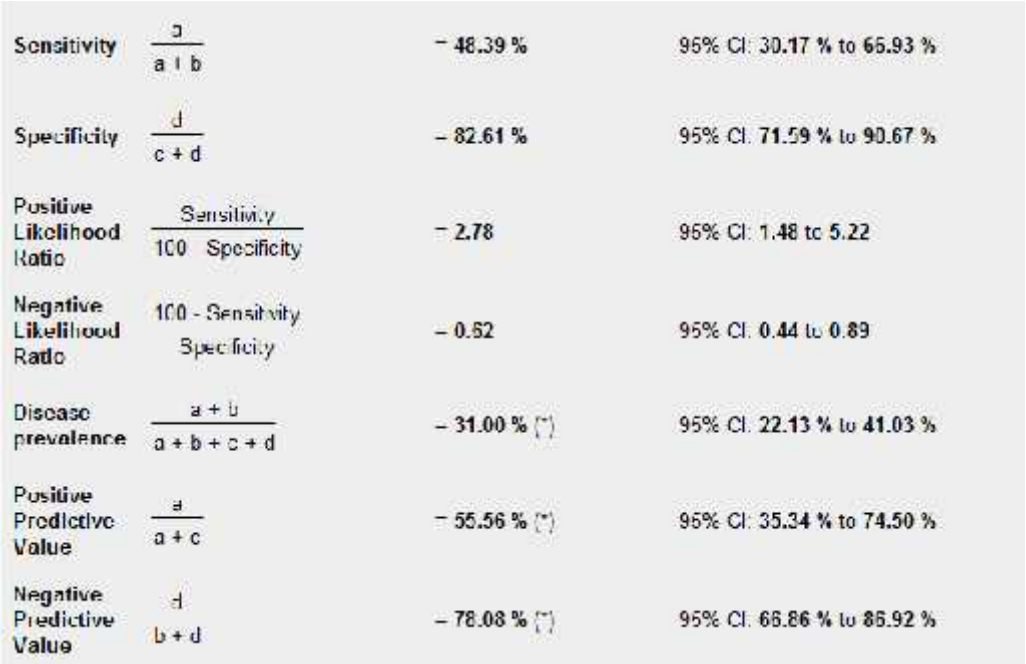
Significance of fever in management:

	Fever Positive	Fever Negative
Surgical	26	1
Conservative	1	72

Sensitivity	$\frac{a}{a+b}$	= 96.30 %	95% CI: 80.97 % to 99.38 %
Specificity	$\frac{d}{c+d}$	= 98.63 %	95% CI: 92.57 % to 99.77 %
Positive Likelihood Ratio	$\frac{\text{Sensitivity}}{100 - \text{Specificity}}$	= 70.30	95% CI: 10.02 to 493.07
Negative Likelihood Ratio	$\frac{100 - \text{Sensitivity}}{\text{Specificity}}$	= 0.04	95% CI: 0.01 to 0.26
Disease prevalence	$\frac{a+b}{a+b+c+d}$	= 27.00 % (*)	95% CI: 18.61 % to 36.80 %
Positive Predictive Value	$\frac{a}{a+c}$	= 96.30 % (*)	95% CI: 80.97 % to 99.38 %
Negative Predictive Value	$\frac{d}{b+c}$	= 98.63 % (*)	95% CI: 92.57 % to 99.77 %

Significance of constipation in management:

	Constipation positive	Constipation negative
Surgical	15	12
Conservative	16	57



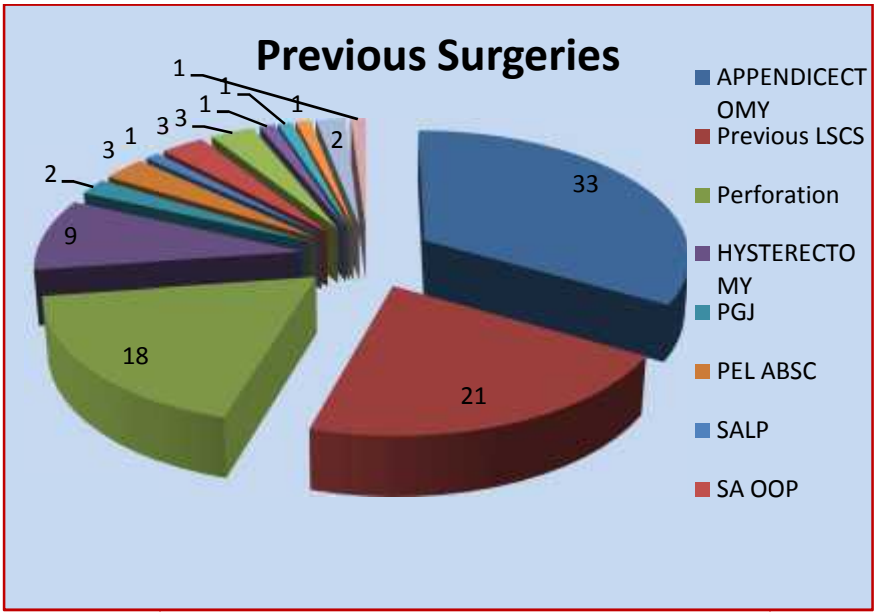
Sensitivity	$\frac{a}{a+b}$	= 48.39 %	95% CI: 30.17 % to 66.93 %
Specificity	$\frac{d}{c+d}$	= 82.61 %	95% CI: 71.59 % to 90.67 %
Positive Likelihood Ratio	$\frac{\text{Sensitivity}}{100 - \text{Specificity}}$	= 2.78	95% CI: 1.48 to 5.22
Negative Likelihood Ratio	$\frac{100 - \text{Sensitivity}}{\text{Specificity}}$	= 0.62	95% CI: 0.44 to 0.89
Disease prevalence	$\frac{a+b}{a+b+c+d}$	= 31.00 % (*)	95% CI: 22.13 % to 41.03 %
Positive Predictive Value	$\frac{a}{a+c}$	= 55.56 % (*)	95% CI: 35.34 % to 74.50 %
Negative Predictive Value	$\frac{d}{b+d}$	= 78.08 % (*)	95% CI: 66.86 % to 86.92 %

The above calculation is done using medcalc software.

www.medcalc.org/calc/diagnostic_test.php

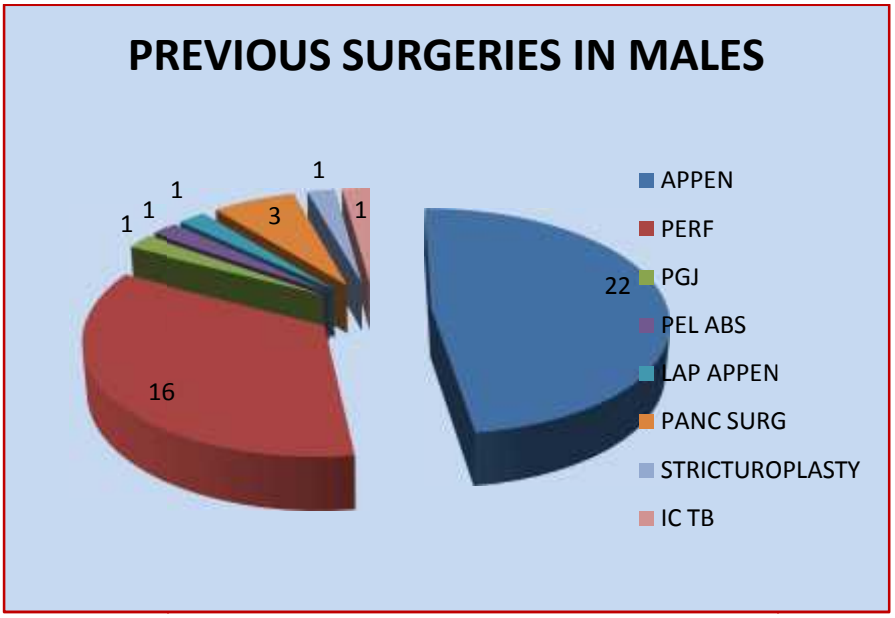
Analysis of previous surgery:

Chart-5



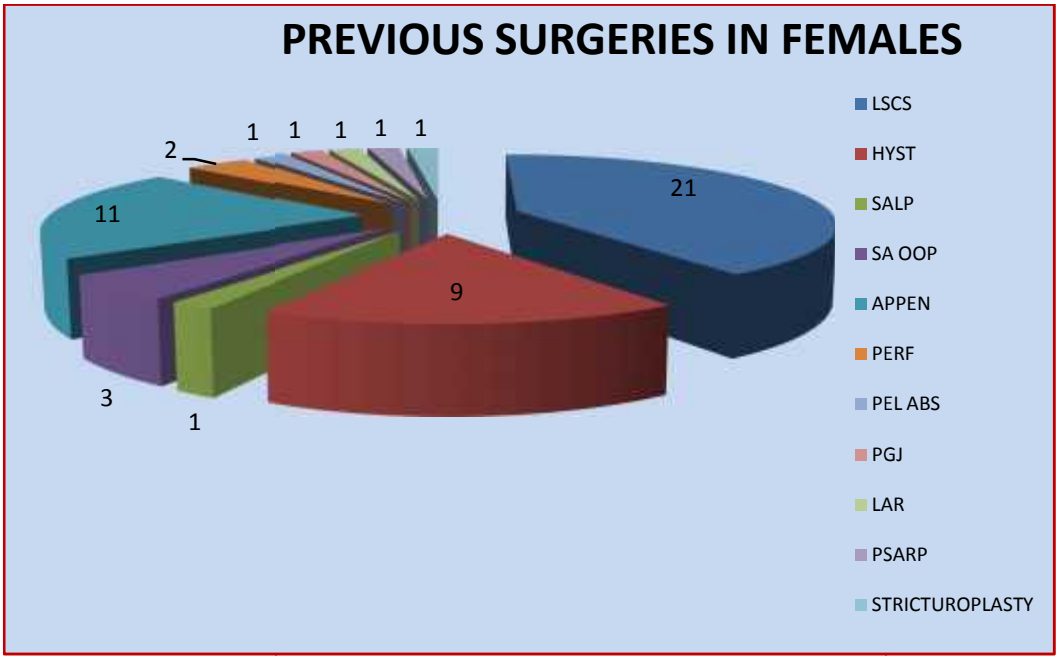
Previous surgeries in males:

Chart-6



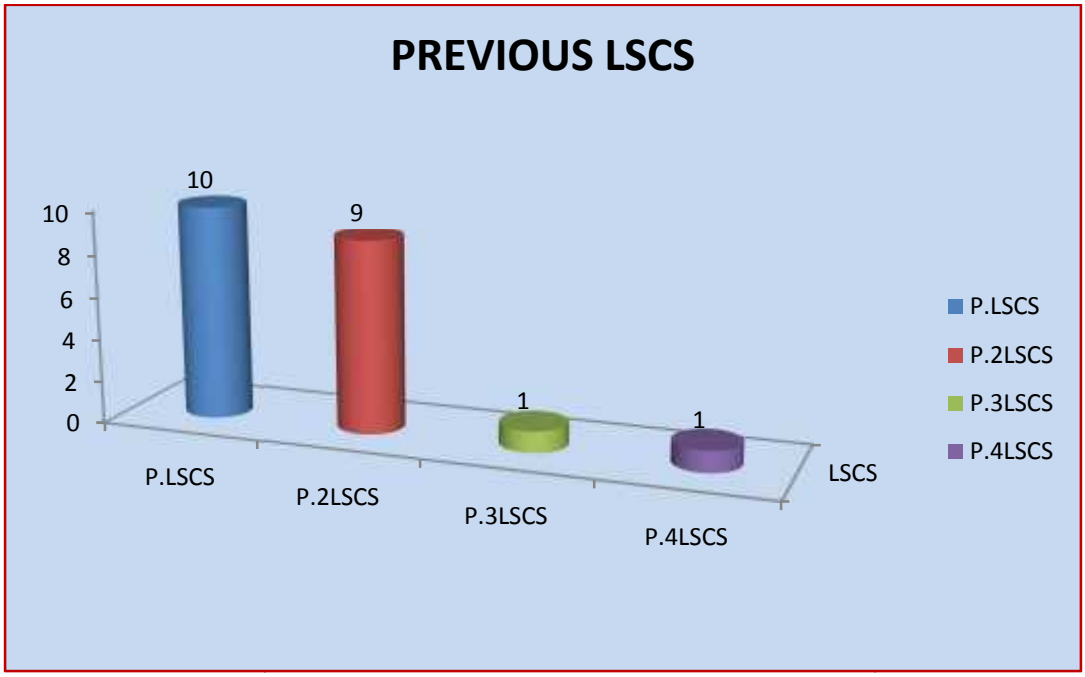
Previous surgeries in females:

Chart-7



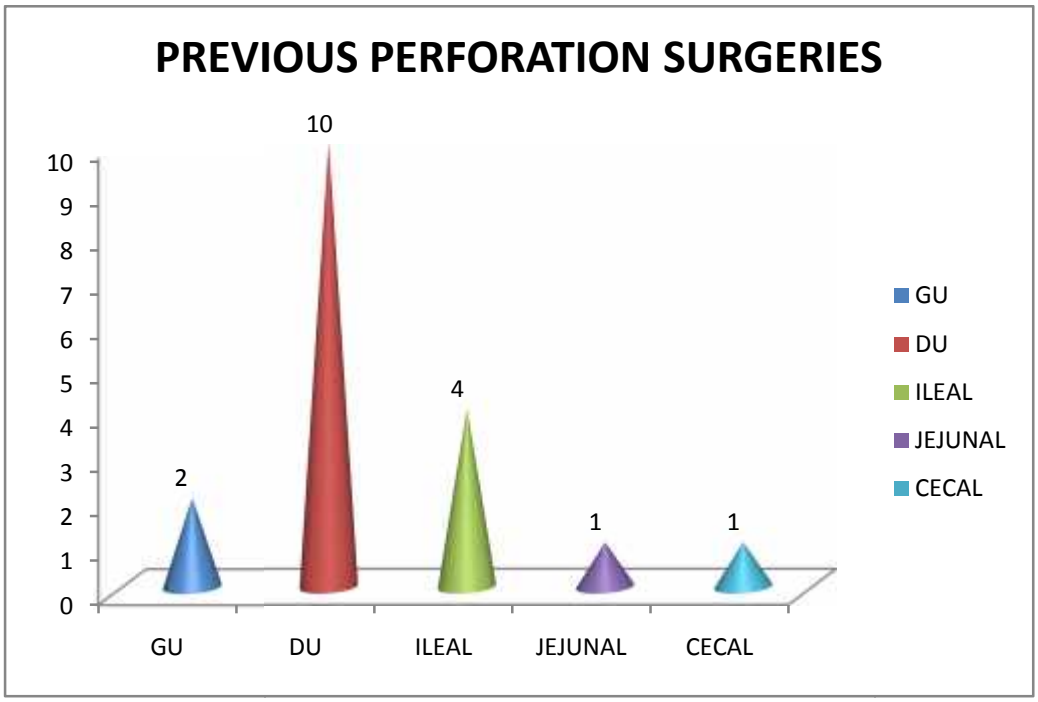
Analysis of previous LSCS:

Chart-8



Previous perforation surgeries:

Chart-9



Laparotomies for Hollow viscous perforation	Number of Patients
Duodenal ulcer	10
Gastric ulcer	2
Ileal perforation	4
Jejunal perforation	1
Cecal perforation	1

Analysis of previous similar episodes:

Chart-10

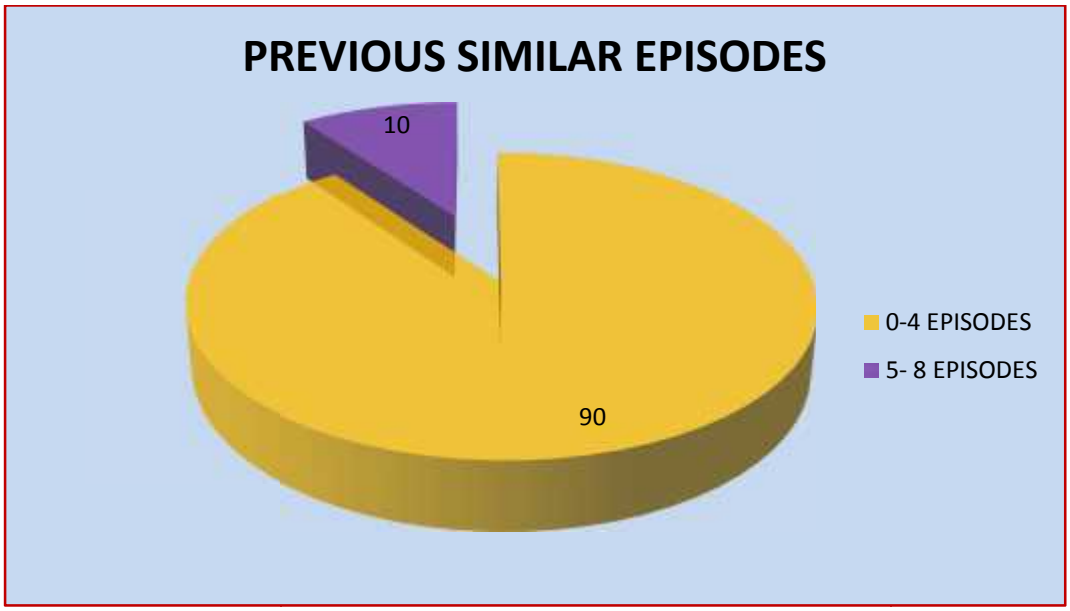
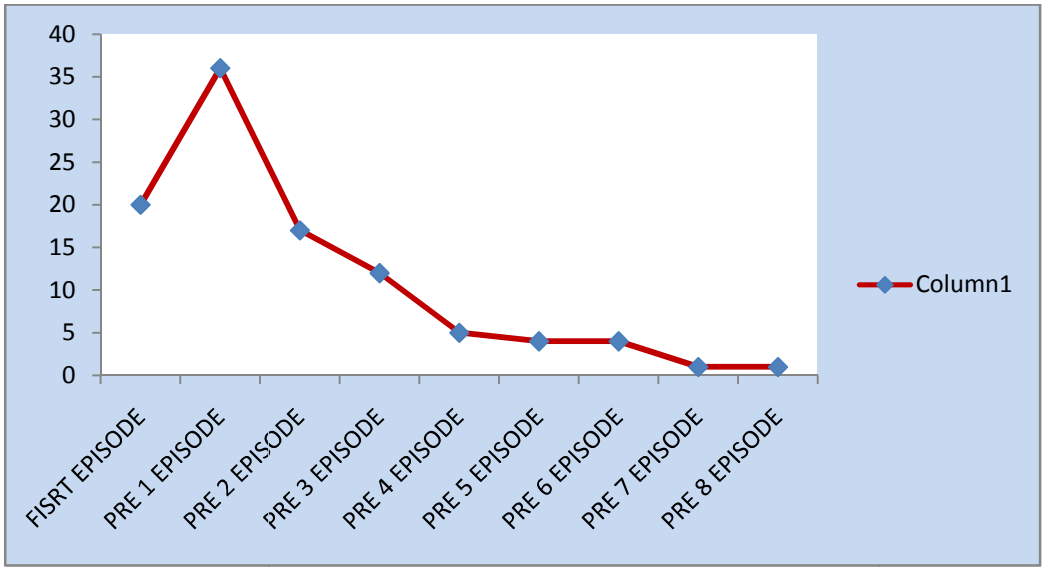
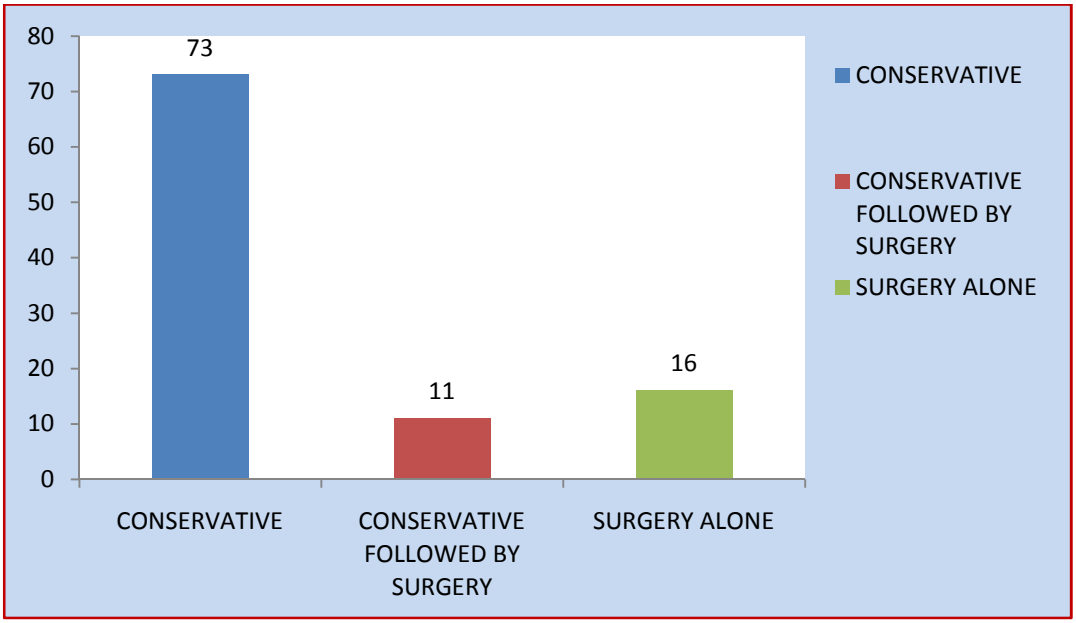


Chart-11



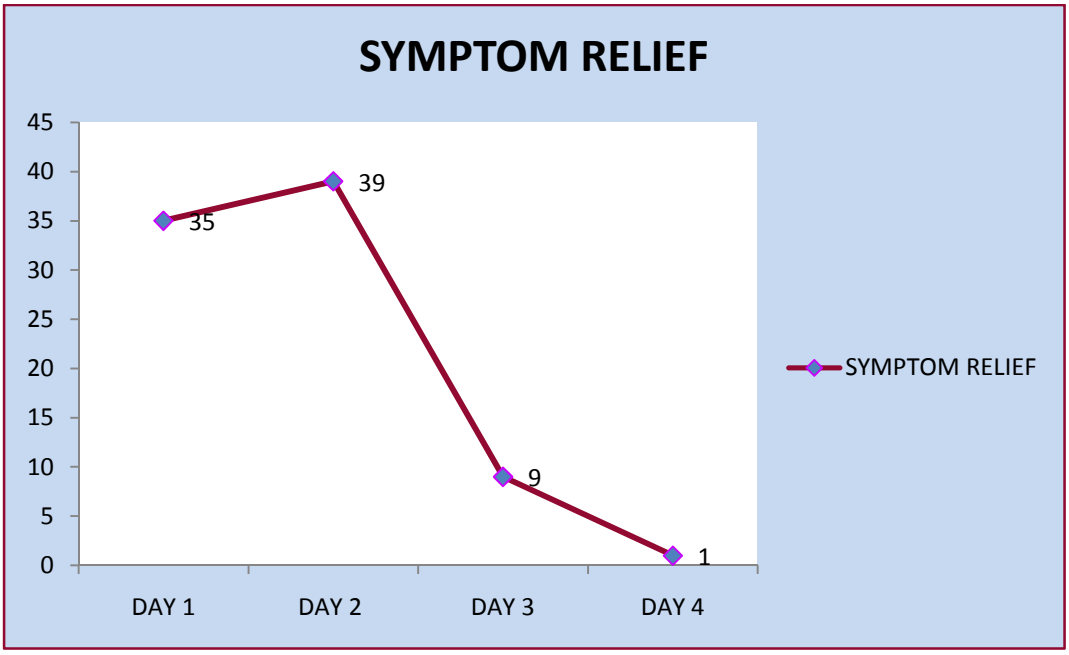
Management analysis:

Chart-12



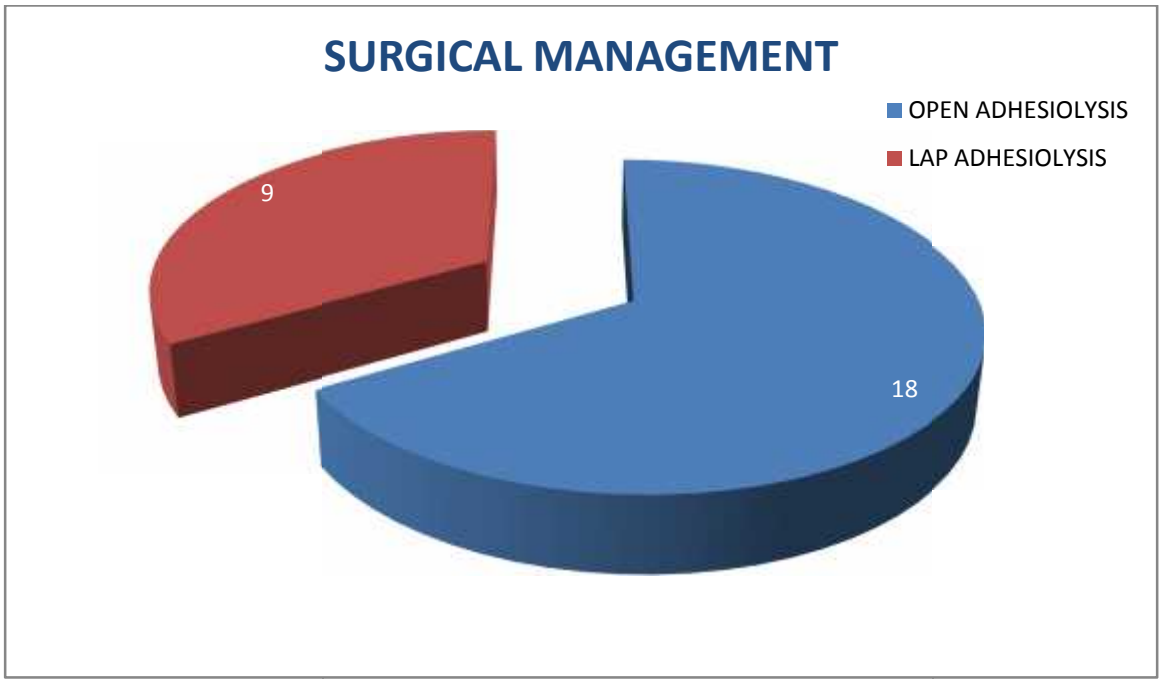
Analysis of conservative management:

Chart-13



Analysis of surgical management:

Chart-14



RESULTS

Results

In this study, the cohort is divided into four age groups. Most of the patients in the cohort belong to 26 to 45 years of age accounting to 55%. The age group 46 to 65 years is affected next. They constitute 34%. The least affected age groups are 18 to 25 years (7%) and those greater than 66 years of age (4%).

Chart-2 is a pie chart showing the male female ratio in this study. This study shows out of 100 patients, 46% of the male patients had Adhesive Small Bowel Obstruction and 54% of the females had Adhesive Small Bowel Obstruction.

The abdominal pain is the most common symptom accounting for 85% of the symptoms. Vomiting occurs in 43% of the symptoms. Fever occurs in 27% of the symptoms but it is significant if this symptom is present the management is surgical approach.

Fever in adhesive small bowel obstruction indirectly infers that there is underlying peritonitis or evolving sepsis. So when the patient presents with fever there is no role for conservative management. The sensitivity and

specificity is 96.30% and 98.63%. This is the most reliable symptom to take up the patient for surgical management.

Constipation or obstipation was present in 31 % but it is significant in only in the presence of all other symptoms. All these symptoms when analyzed alone may have less significance but when the symptoms are added together the significance increases.

Chart-5 is a pie chart showing the various previous surgeries for which the patient attended the hospital with symptoms suggestive of adhesive small bowel obstruction. According to this study, the previous history of appendicectomy is the most common cause followed by hollow viscous perforation which constitutes 33% and 18% respectively of the cause for adhesive small bowel obstruction.

In males previous history of Appendicectomy and previous history of Perforation are the two most common causes which led to adhesion formation. (Chart-6) These two account for more than 65% of the previous surgeries in males.

In females the most common surgery which led to adhesion formation is previous LSCS which accounts for 35% of the causes for adhesion. The

next common surgeries in the females are Appendicectomy and Hysterectomy.

The bar diagram (chart-8) shows the number of previous LSCS showing the formation of adhesions. In this study the adhesion formation is more common in previous one LSCS and previous two LSCS. But in reality it should be more number of surgeries performed should increase the adhesion formation rate.

Out of 18 Laparotomy done for hollow viscous perforation, (chart-9) Laparotomy done for Duodenal Ulcer perforation is found to be the most common cause for adhesion formation.

In Chart-10 and chart-11, the previous similar episode in the patients who were diagnosed as adhesive small bowel obstruction is shown. The data from this study shows that all the patients with previous surgeries will have at least one episode of abdominal colic.

Chart-12 is a bar diagram showing the various management in Adhesive Small Bowel Obstruction is open Adhesiolysis and laparoscopic Adhesiolysis.

Regarding the management, the commonest is conservative management (73%). Few cases have been managed conservatively but in

due course these patients were subjected to surgery (11%) as they did not get symptomatic relief. (Chart-14)

Surgical management (27%) was advocated for those patients with features of peritonitis and those who did not have symptomatic relief. Around 73% of the patients were managed conservatively. Of which 71 % of the patients had symptomatic relief within 48 hours of conservative management. The majority of remaining patients had symptomatic relief within 72 hours of conservative management.

Chart- 14 is a pie chart showing the open and laparoscopic Adhesiolysis done for Adhesive Small Bowel Obstruction. Open surgeries are done in 76% of the population and 24 % underwent Laparoscopic Adhesiolysis.

DISCUSSION

In this study the appendicitis is the most common cause of adhesion formation (33%). The other major cause of adhesion formation is due to LSCS (21%). Both these conditions are more common in younger age group.

In age groups more than 65 and 18- 25 there are less number of surgeries performed. This study lacks in follow up of these patients in this age group. So the number of patients who have undergone Adhesiolysis in this group is not known after the study.

There is no significant difference in male and female sex in adhesive small bowel obstruction. (Chart-2)

Though abdominal pain is the common symptom of adhesive small bowel obstruction many abdominal conditions present with abdominal pain. According to this study, abdominal pain is more specific (100%) in diagnosing the disease but it is less sensitive (31.76%) in taking decision regarding surgical management.

In this study, the sensitivity of vomiting as the symptom for surgical management is less (41.86%). But it has got better specificity (85.94%). Vomiting is also present in many other abdominal pathology. Abdominal distention is found in 58% of patients. This is a reliable symptom.

Abdominal distension is due to five ‘Fs’ fat, fluid, feces, fetus, flatus. Due to adhesive obstruction there is accumulation of fluid and flatus. So this symptom becomes reliable in adhesive small bowel obstruction. Though it is reliable, abdominal distension also occurs in colonic obstruction. The abdominal distension has sensitivity of 37.93% for surgical management and specificity of 90.74%.

As females are also included in this study the previous Lower Segment Caesarian Section has also been a cause of adhesive small bowel obstruction which constitutes 21% of the cause. Hysterectomy accounts for 9% of the causes of adhesion. Other causes are Stricturoplasty in Tuberculosis, Salphingo Oophorectomy, Salphingectomy, PSARP (Posterior saggital Ano Rectoplasty), pancreatic surgery like Freys Procedure, Puestows Procedure, Pelvic Abscess, Posterior Gastrojejunostomy for Benign stricture and Illeo cecal Tuberculosis.

In analysis of the previous surgeries, the most common cause of adhesion formation is due to infective causes which led to the surgery than other causes which led to the surgery. Other factor which coincides with the international standard is pelvic surgeries are more prone for Adhesion formation.

In females the Gynecological surgeries dominate in formation of adhesions. In this study the reasons for less number of people with adhesion in previous three and four LSCS are due to small sample size of patients who have undergone third and fourth LSCS (may be due to Puerperal Sterilization).

Duodenal perforation is because in our locality the most common emergency Laparotomy revealed duodenal perforation. Although the adhesions are more common in pelvic surgeries, according to this study it says the probable cause of adhesion formation is due to Laparotomy for Duodenal perforation. The other causes of Laparotomy are for gastric ulcer perforations, Ileal perforation, jejunal perforation and Cecal perforation.

As the number of surgeries increases the adhesion formation increases. More over the previous episodes are increased in pelvic surgeries like abdominal Hysterectomy, Low anterior resection, previous LSCS. The more the pelvic surgeries, there are more adhesions formation.

Most of the patients had one previous similar episode. The inference from chart 13 is that if the patients do not have symptomatic relief within 48-72 hours the conservative management is not going to help the patient.

Inadvertent enterostomy is a complication of both Open and Laparoscopic Adhesiolysis. Laparoscopic Adhesiolysis is done in this study as an elective procedure after failed conservative management.

Hypothesis and scoring system developed from this study:

Comparing all the symptoms with the management option, a scoring system is developed to select the patients for type of management.

Symptom	Sensitivity	Specificity	Score given
Abdominal pain	31.76	100	1
Vomiting	41.86	85.94	1
Abdominal distension	37.93	90.74	1
Fever	96.30	98.63	2
Constipation/Obstipation	48.39	82.61	1

The scoring assigned is in such a way if the sensitivity and specificity is more than 80%, one score is given. So the total score for these symptoms comes to 6. It is observed that the patients who scored two are subjected for conservative treatment. Those scored 3 and 4 can be subjected for conservative management but there are high chances for them to go for surgical management. These patients can be taken up for elective laparoscopic Adhesiolysis. Patients who scored five and six are subjected for surgical management. If these patients are subjected for conservative management they may go for laparoscopic Adhesiolysis.

CONCLUSION

CONCLUSION

Adhesion is the most common cause of small bowel obstruction. In this study, the patients who have undergone previous surgery. The commonest symptoms of Adhesive Small bowel Obstruction are abdominal pain and vomiting. But sensitivity is less in decision making for surgical intervention. Fever has high sensitivity (96%) and specificity (98%) in decision making for surgical management.

From the demographic analysis, the majority of the patients are in the age group of 25-45 years of age. In this cohort, the commonest previous surgeries leading on to adhesive small bowel obstruction are previous appendicectomy, previous hollow viscous perforation, previous LSCS, previous hysterectomy which are different from the standard causes of adhesive small bowel obstruction like Colonic surgeries, Cholecystectomies in western population.

A scoring system was developed from this Observational study. This scoring system does not fit into four patients out of 100 patients who took part in this study. The sensitivity and specificity of this scoring system should be proved in a study of appropriate sample size.

MASTER CHART

Master chart

S.No	Name of the Patient	Age	Sex	Symptoms					Signs	Previous surgery	No of prev epi	X-Ray	CONS Management	Open / laparoscopic
				Abd pain	Vomit	Abd dis	Fever	Consti/ obsti					SYMP REL DAY	
1.	DEVIKALA	36	F	+	-	+	+	+	AT,NGR	PRE TB	2	DBL	CONS/2	OPEN ADH
2.	SUNDARAMURTHY	40	M	+	+	-	-	-	AT,NGR	APPEN	2	DBL	CONS/2	-
3.	SURESH	35	M	+	-	-	-	-	AT,NGR	APPEN	1	DBL	CONS/2	-
4.	DEVI	41	F	+	-	-	-	+	AT,NGR	P.2LSCS	4	DWL	CONS/3	-
5.	FRANCIS	42	M	+	-	+	-	-	AT,NGR	APPEN	2	DBL	CONS/2	-
6.	PANDIAN	55	M	+	+	+	+	+	AT,G,R	GU PERF	1	MAL	-	OPEN ADH
7.	SUNDAR RAJAN	64	M	+	+	-	-	+	AT,NGR	DU PERF	1	DBL	CONS/2	-
8.	SRIRAMULU	51	M	+	-	-	-	-	AT,NGR	PGJ	1	DBL	CONS/2	-
9.	MARYROSE	40	F	+	-	+	-	-	AT,G,NR	PEL ABC	2	DBL	CONS/1	-
10.	KUMARI	36	F	-	+	-	-	-	AT,NGR	P.LSCS	0	DBL	CONS/1	-
11.	KUPAMMAL	64	F	+	-	+	+	+	AT,G,NR	HYST	0	MAL	CONS/3	LAP ADH
12.	RADHARAMANI	30	F	+	-	-	-	-	AT,NGR	P.2LSCS	0	DBL	CONS/1	-
13.	PARASURAMAN	41	M	+	-	+	-	-	AT,NGR	DU PERF	1	MAL	CONS/3	-
14.	SELVAKUMARI	58	F	+	+	+	+	+	AT,G,NR	P.2LSCS	2	MAL	-	OPEN ADH
15.	HARISINGH	71	M	+	-	+	+	-	AT,G,R	DU PERF	1	MAL	-	OPEN ADH
16.	SUBRAMANI	48	M	+	-	-	-	+	AT,NGR	APPEN	1	DBL	CONS/2	-
17.	RAGAVENDAR	26	M	+	+	-	-	-	AT,NGR	APPEN	0	DBL	CONS/2	LAP ADH
18.	PRIYA	27	F	+	-	-	+	-	AT,NGR	APPEN	5	DBL	CONS/2	LAP ADH
19.	PURUSHOTHAMAN	42	M	+	+	-	-	-	AT,NGR	FREYS	2	DBL	CONS/3	-
20.	AMUTHA	34	F	-	-	+	-	-	AT,NGR	P.LSCS	2	DBL	CONS/2	-

S.No	Name of the Patient	Age	Sex	Symptoms					Signs	Previous surgery	No of prev epi	X-Ray	Management	Open / laparoscopic
				Abd pain	Vomit	Abd dis	Fever	Consti/ obsti						
21.	KANNIYAMMAL	24	F	-	-	+	-	-	SOFT	P.LSCS	1	DBL	CONS/1	-
22.	VEERAMANI	60	F	+	+	+	-	-	AT,G,NR	P.2LSCS	0	DBL	CONS/2	-
23.	BALARAMAN	44	M	+	-	-	-	-	AT,NGR	APPEN	0	DBL	CONS/1	-
24.	ANJALI	42	F	+	-	-	+	-	AT,NGR	SALP	3	DBL	CONS/2	LAP ADH
25.	KUMARESAN	52	M	+	-	-	+	-	AT,G,R	ILL PERF	0	DBL	CONS/2	OPEN ADH
26.	DURAI	39	M	-	-	+	-	-	SOFT	APPEN	2	DBL	CONS/2	-
27.	SUPRIYA	22	F	+	-	+	-	-	AT, NGR	P.LSCS	0	MAL	CONS/1	-
28.	VANITHA	22	F	+	-	-	-	-	AT,NGR	APPEN	0	DBL	CONS/3	-
29.	RATHINAMMAL	31	F	+	+	+	-	-	SOFT	P.2LSCS	1	MAL	CONS/2	-
30.	RAMKUMAR	65	M	+	+	+	+	+	AT,G,R	DU PERF	7	MAL	-	OPEN ADH
31.	RAMASAMY	30	M	+	-	-	-	-	SOFT	LAP AP	2	DBL	CONS/1	-
32.	MALARVIZHI	65	F	+	-	+	-	-	AT, NGR	HYST	1	DBL	CONS/2	-
33.	RAGHURAMAN	31	M	+	-	+	-	+	AT,NGR	APPEN	0	MAL	CONS/1	-
34.	VIDHYA	26	F	-	-	+	-	-	AT,NGR	P.LSCS	1	DBL	CONS/1	-
35.	KAMALA	55	F	+	-	+	-	-	AT,NGR	HYST	0	DBL	CONS/1	-
36.	KARTHIGALAKSHMI	63	F	+	+	+	+	-	AT,NGR	APPEN	2	MAL	-	OPEN ADH
37.	SANGEETHA	43	F	+	-	-	-	-	SOFT	P.3LSCS	1	DBL	CONS/1	-
38.	VARADHAN	48	M	+	+	+	-	-	AT,NGR	JEJ PERF	1	DBL	CONS/3	-
39.	SELVI	21	F	-	-	+	-	-	SOFT	P.2LSCS	1	DBL	CONS/1	-
40.	KALAI	23	F	-	-	+	-	+	SOFT	P.LSCS	0	DBL	CONS/1	-

S.No	Name of the Patient	Age	Sex	Symptoms					Signs	Previous surgery	No of prev epi	X-Ray	Management	Open / laparoscopic
				Abd pain	Vomit	Abd dis	Fever	Consti/ obsti						
41.	LALITHA	37	F	-	-	+	-	-	SOFT	APPEN	2	DBL	CONS/1	-
42.	ALIYABEGAM	45	F	+	+	-+	-	-	AT,NGR	P.LSCS	3	DBL	CONS/2	-
43.	FEROZALI	31	M	+	+	+	+	-	AT,G,NR	APPEN	3	DBL	-	OPEN ADH
44.	SARASWATHI	65	F	+	-	-	-	-	SOFT	SA OOP	6	DBL	CONS/3	-
45.	DEVAN	44	M	+	+	-	-	-	AT	APPEN	3	DWL	CONS/1	-
46.	NASHEED AHMED	45	M	+	+	+	+	+	AT,G,R	DU PERF	0	MAL	-	OPEN ADH
47.	PARAMESWARAN	37	M	+	+	+	+	-	AT,G,R	APPEN	4	DWL	CONS/2	LAP ADH
48.	PARUVATHAMMAL	51	F	-	-	+	-	-	SOFT	APPEN	3	MAL	CONS/1	-
49.	SARROJINI	45	F	+	-	+	-	-	AT,NGR	ILL PERF	1	MAL	CONS/2	-
50.	PUGALENDI	31	M	+	+	+	+	+	AT,G,R	PUEST	3	MAL	-	OPEN ADH
51.	TAMILSELVI	33	F	+	-	-	-	-	AT,NGR	APPEN	1	DBL	CONS/2	-
52.	GANESAN	28	M	+	-	-	-	+	AT,NGR	ILL PERF	1	DWL	CONS/3	-
53.	SELVAM	54	M	+	-	+	-	-	AT,NGR	APPEN	2	DBL	CONS/2	-
54.	ANNAMAL	53	F	+	+	+	+	+	AT,G,R	GU PERF	1	MAL	-	OPEN ADH
55.	SUSILA	33	F	+	+	-	-	+	AT,NGR	APPEN	1	DBL	CONS/2	-
56.	SAVITHRI	41	F	+	-	-	-	-	AT,NGR	PGJ	1	DBL	CONS/2	-
57.	INDRAN	52	M	+	-	+	+	-	AT,G,NR	PEL ABC	2	DBL	CONS/1	-
58.	RAJAATHINAM	35	M	-	+	-	-	-	AT,NGR	IC TB	0	DBL	CONS/1	-
59.	RAMACHANDRAN	53	M	+	-	+	+	+	AT,G,NR	PRE TB	0	MAL	CONS/1	OPEN ADH
60.	NAGALINGAM	47	M	+	-	-	-	-	AT,NGR	LIV ABS	0	DBL	CONS/1	-

S.No	Name of the Patient	Age	Sex	Symptoms					Signs	Previous surgery	No of prev epi	X-Ray	Management	Open / laparoscopic
				Abd pain	Vomit	Abd dis	Fever	Consti/ obsti						
61.	BABU	33	M	-	-	+	-	-	SOFT	APPEN	0	DBL	CONS/1	-
62.	SHAKIRALI	46	M	+	+	-	-	+	AT,NGR	APPEN	1	DBL	CONS/2	-
63.	BABU	38	M	+	+	+	-		AT,NGR	APPEN	1	DBL	CONS/1	-
64.	MUTHARASI	27	F	+	+	-	-	+	AT,NGR	P.4LSCS	1	DBL	CONS/2	-
65.	VASANTHA	39	F	+	-	+	-	-	AT,NGR	HYST	1	DBL	CONS/2	-
66.	SAMBATH	54	M	+	+	-	-	+	AT,NGR	DU PERF	1	DBL	CONS/2	-
67.	DEVARAJ	61	M	+	+	-	-	+	AT,NGR	DU PERF	1	DBL	CONS/2	-
68.	TAMILARASI	56	F	+	-	-	-	-	AT,NGR	HYST	1	DBL	CONS/2	-
69.	MAGESWARI	32	F	+	-	+	+	-	AT,G,NR	APPEN	2	DBL	CONS/1	LAP ADH
70.	SIVAGAMI	51	F	-	+	-	-	-	AT,NGR	CE PERF	4	DBL	CONS/4	-
71.	RAGAVAN	44	M	+	+	-	-	+	AT,NGR	APPEN	1	DBL	CONS/2	-
72.	MAHALAKSHMI	52	F	+	-	+	-	-	AT,NGR	HYST	1	DBL	CONS/2	-
73.	SHANMUGAM	49	M	+	+	+	+	+	AT,G,R	DU PERF	0	MAL	-	OPEN ADH
74.	ARULMANI	41	M	+	+	+	+	-	AT,G,R	APPEN	1	DWL	-	LAP ADH
75.	PANCHACHARAM	65	M	+	+	+	+	+	AT,G,R	DU PERF	0	MAL	-	OPEN ADH
76.	SANTHAKUMAR	29	M	+	+	-	-	+	AT,NGR	APPEN	1	DBL	CONS/2	-
77.	JOTHI	31	F	+	-	-	-	-	AT,NGR	APPEN	1	DBL	CONS/2	-
78.	LALITHA	71	F	+	-	+	-	-	AT,G,NR	PEL ABC	2	DBL	CONS/1	-
79.	KAMALAVENI	69	F	+	+	+	-	-	AT,NGR	HYST	0	DBL	CONS/1	-
80.	BANU	37	F	+	+	-	-	+	AT,NGR	APPEN	1	DBL	CONS/2	-

S.No	Name of the Patient	Age	Sex	Symptoms					Signs	Previous surgery	No of prev epi	X-Ray	Management	Open / laparoscopic
				Abd pain	Vomit	Abd dis	Fever	Consti/ obsti						
81.	AMUTHAVALLI	28	F	+	-	-	-	-	AT,NGR	P.2LSCS	2	DBL	CONS/1	-
82.	SHAKEELABEGUM	20	F	+	+	+	-	+	AT,G	PSARP	1	DBL	CONS/2	-
83.	THASEEN	32	F	+	-	-	+	+	AT,NGR	P.2LSCS	3	MAL	CONS/1	LAP ADH
84.	CHANDRAMANI	69	F	+	+	+	+	+	AT,G,R	LAR	6	MAL	-	OPEN ADH
85.	POWNAMMAL	37	F	-	-	+	-	-	SOFT	P.LSCS	1	DWL	CONS/1	-
86.	DHANALAKSHMI	63	F	+	-	+	-	-	AT,NGR	HYST	5	MAL	CONS/1	-
87.	RAJENDIRAN	55	M	-	-	+	-	-	SOFT	APPEN	2	DBL	CONS/1	-
88.	SELLAMMAL	31	F	+	+	-+	-	-	AT,NGR	P.LSCS	3	DBL	CONS/2	-
89.	KAMSAMMAL	61	F	+	+	+	+	-	AT,G,NR	HYST	3	DBL	-	OPEN ADH
90.	MEGALAI	47	F	+	-	-	-	-	SOFT	SA OOP	6	DBL	CONS/3	-
91.	RAHUL	27	M	+	+	-	-	-	AT	APPEN	3	DWL	CONS/1	-
92.	MICHAEL	36	M	+	+	+	+	+	AT,G,NR	DU PERF	4	MAL	-	OPEN ADH
93.	DINESH	27	M	+	+	+	+	-	AT,NGR	APPEN	4	DWL	CONS/2	LAP ADH
94.	NAGARAJAN	22	M	-	-	+	-	-	SOFT	APPEN	3	MAL	CONS/1	-
95.	AYYAVU	49	M	+	-	+	-	-	AT,NGR	ILL PERF	5	MAL	CONS/2	-
96.	KONDAIYAN	55	M	+	+	+	+	+	AT,G,R	FREYS	8	MAL	-	OPEN ADH
97.	ANDAL	35	F	+	-	-	-	+	AT	P.LSCS	1	DWL	CONS/1	-
98.	SHEELA	33	F	-	+	-	-	-	SOFT	P.2LSCS	3	MAL	CONS/1	-
99.	PRAMILA	42	F	-	-	+	-	-	SOFT	SA OOP	5	DWL	CONS/1	-
100.	SHANTHI	38	F	+	-	-	-	-	AT	APPEN	6	MAL	CONS/2	-

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ABBREVIATIONS

Abbreviations

ASBO	- Adhesive Small Bowel Obstruction
TNF	- Tumour Necrosis Factor
MMP	- Matrix Metalloproteinases
tPA	- Tissue Plasminogen Activator
uPA	- Urokinase Type Tissue Plasminogen Activator
PAI	- Platelet activator Inhibitor
MDCT	- Multi Detector Computed Tomography
CT Scan	- Computed Tomography Scan
MRI	- Magnetic Resonance Imaging
rtPA	- Recombinant Tissue Plasminogen Activator
LSCS	- Lower Segment Cesarean Section
PGJ	- Posterior Gastro Jejunostomy
PEL ABSC	- Pelvic Abscess
SALP	- Salphingectomy
SA OOPH	- Salphingo Oophorectomy
PANC SURG	- Pancreatic Surgery
LAR	- Low Anterior Resection
PSARP	- Posterior Sagital Ano Rectoplasty
IC TB	- Ileo Cecal Tuberculosis
LAP APPEN	- Laparoscopic Appendicectomy
PERF	- Hollow Viscous Perforation

DU	- Duodenal Ulcer Perforation
GU	- Gastric Ulcer Perforation
ILL	- Ileal Perforation
CE	- Cecal Perforation
JEJ	- Jejunal Perforation
LAP	- Laparoscopic
AT	- Abdominal Tenderness
G	- Gaurding
R	- Rigidity
NGR	- No Gaurding Rigidty
NG	- No Gaurding
NR	- No Rigidity
DBL	- Dilated Bowel Loop
MAL	- Multiple Air fluid Level.
CONS/1	- Conservative management symptoms relieved by 1 day
CONS/2	- Conservative management symptoms relieved by 2 days
CONS/3	- Conservative management symptoms relieved by 3 days
CONS/4	- Conservative management symptoms relieved by 4 days
LAP ADH	- Laparoscopic Adhesiolysis
OPEN ADH	- Open Adhesiolysis

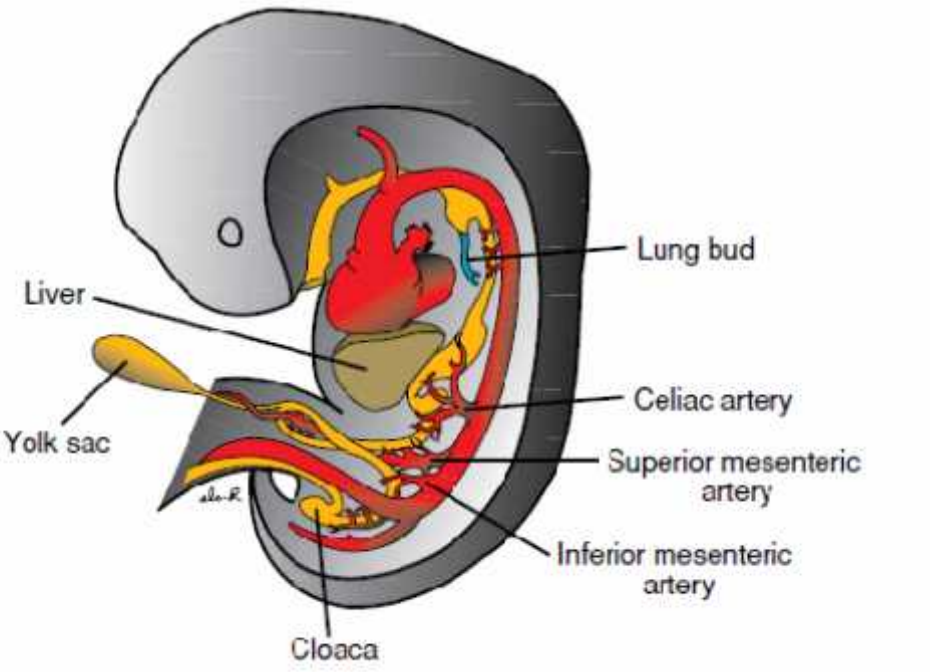


Fig-1: Embryo at sixth week with superior mesenteric artery forming the axis of the midgut

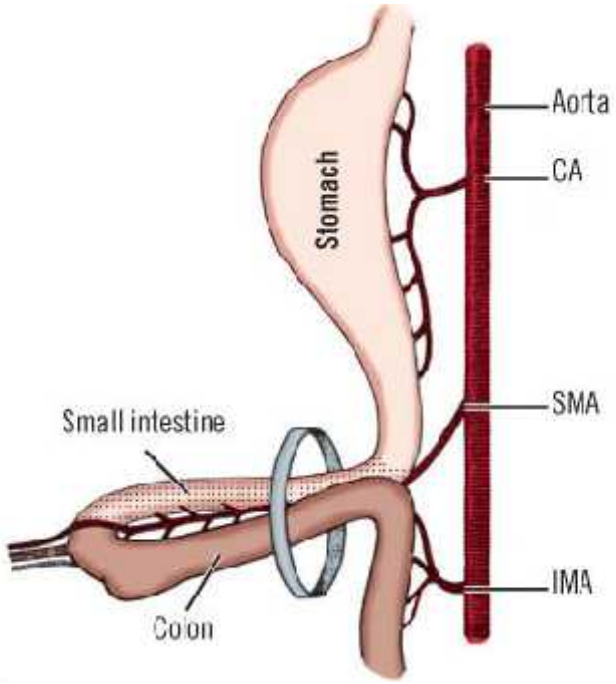


Fig-2: Primitive Gut with the respective blood supply

CA-celiac artery, SMA-superior mesenteric artery, IMA- inferior mesenteric artery

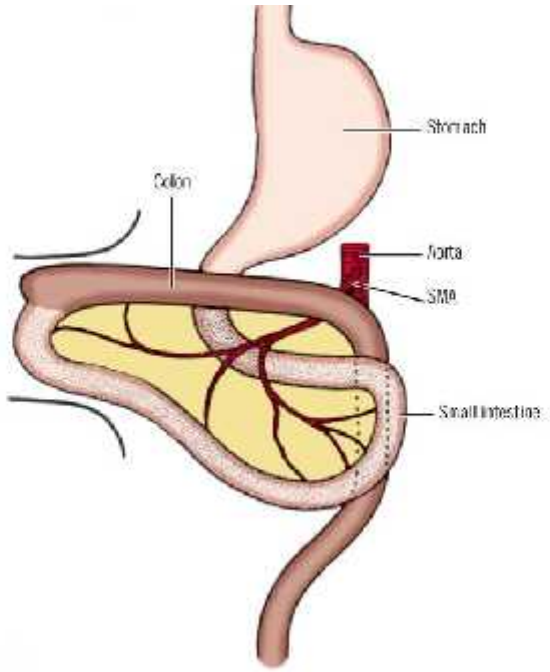


Fig-3: Rotation of the midgut with entry into the abdominal cavity

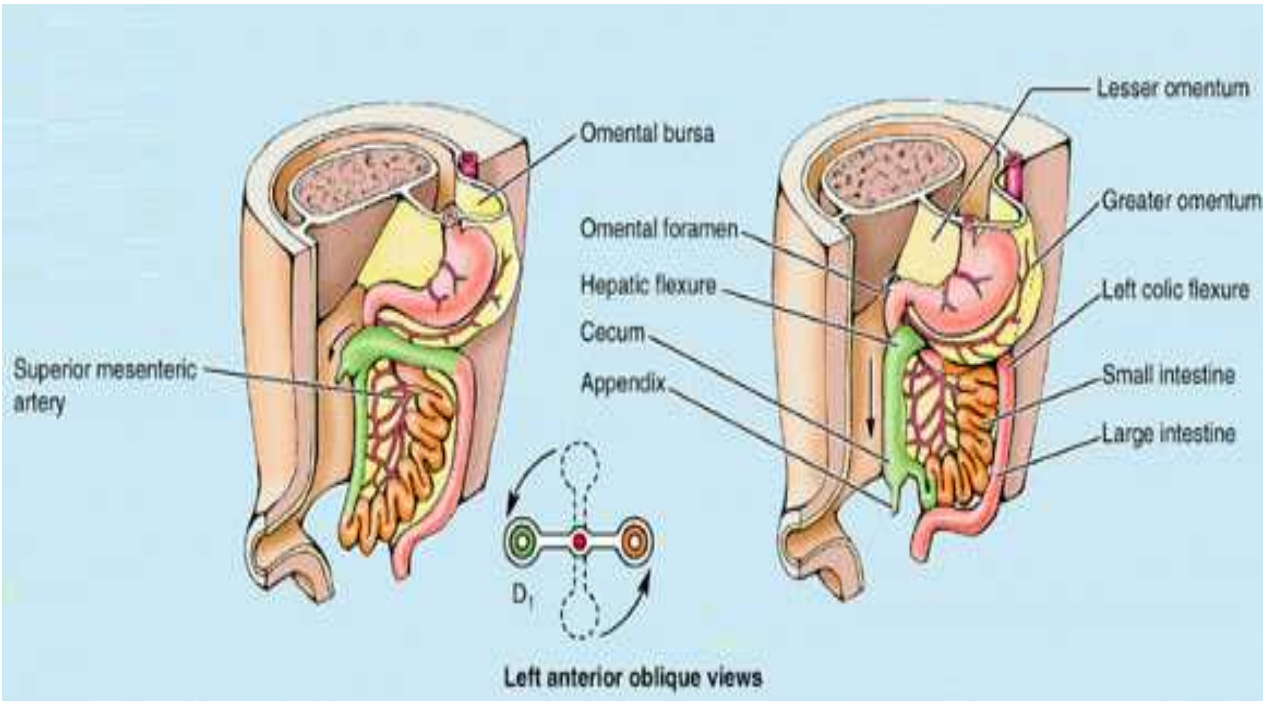


Fig-4: Rotation of midgut and decent of the cecum.

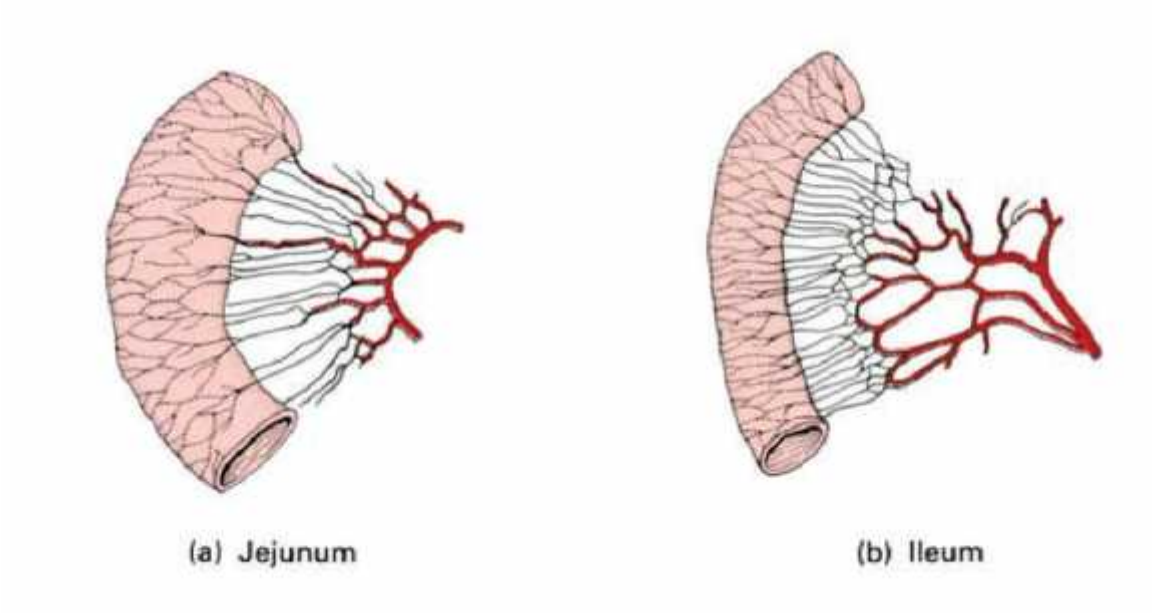


Fig-5 Difference between the jejunum and ileum

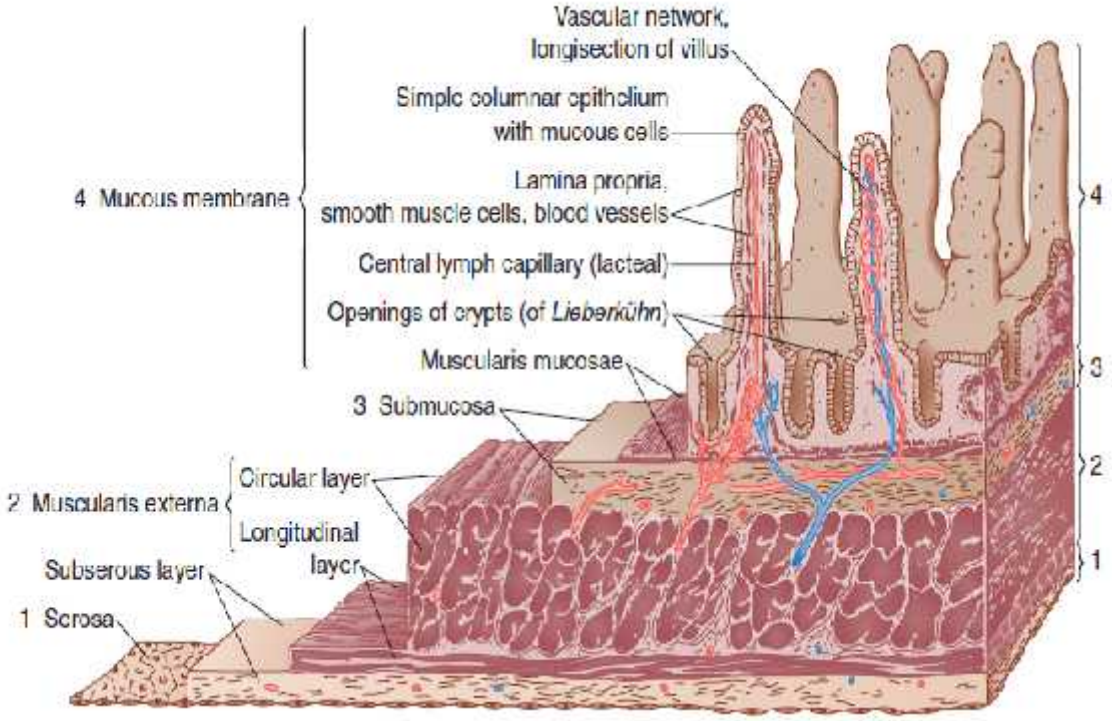


Fig-6 Histology of the small intestine

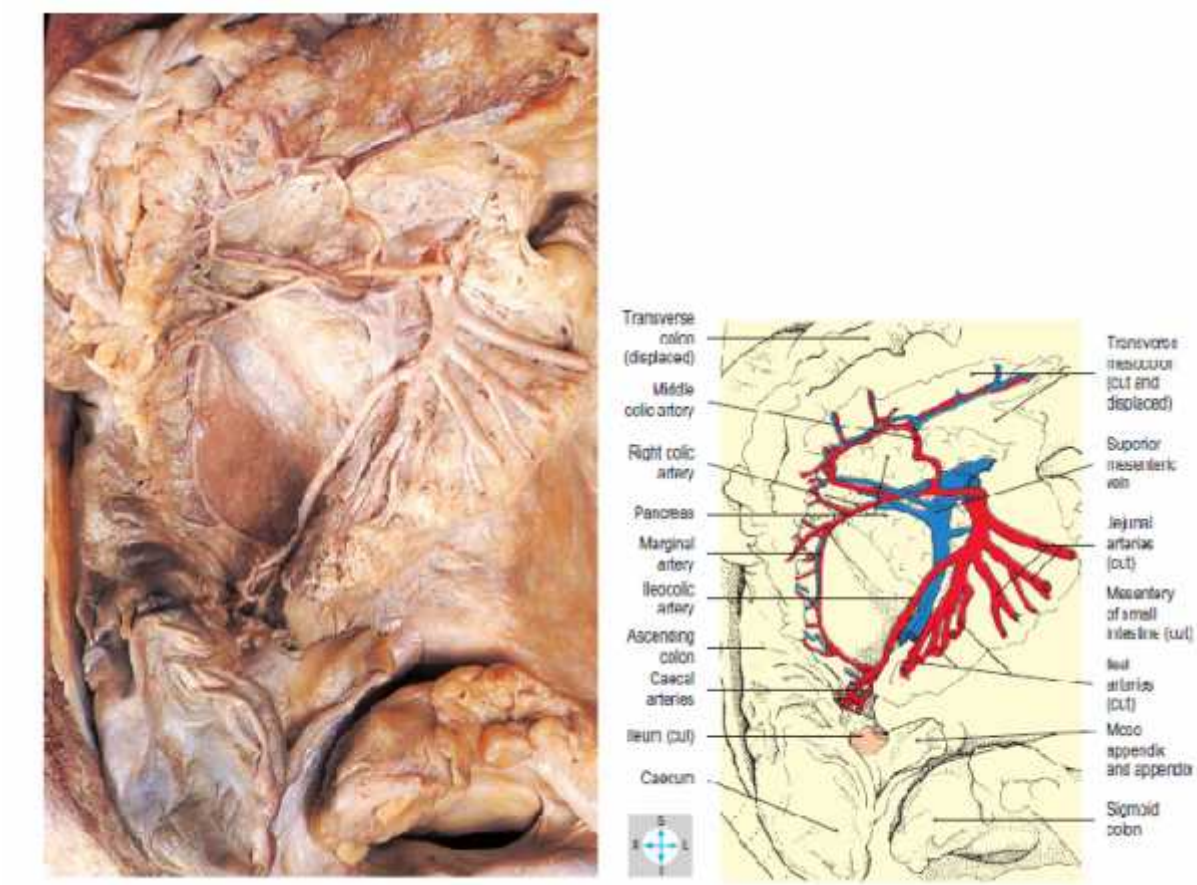


Fig-7 Superior Mesenteric Artery and its Branches (courtesy- Herald Ellis)

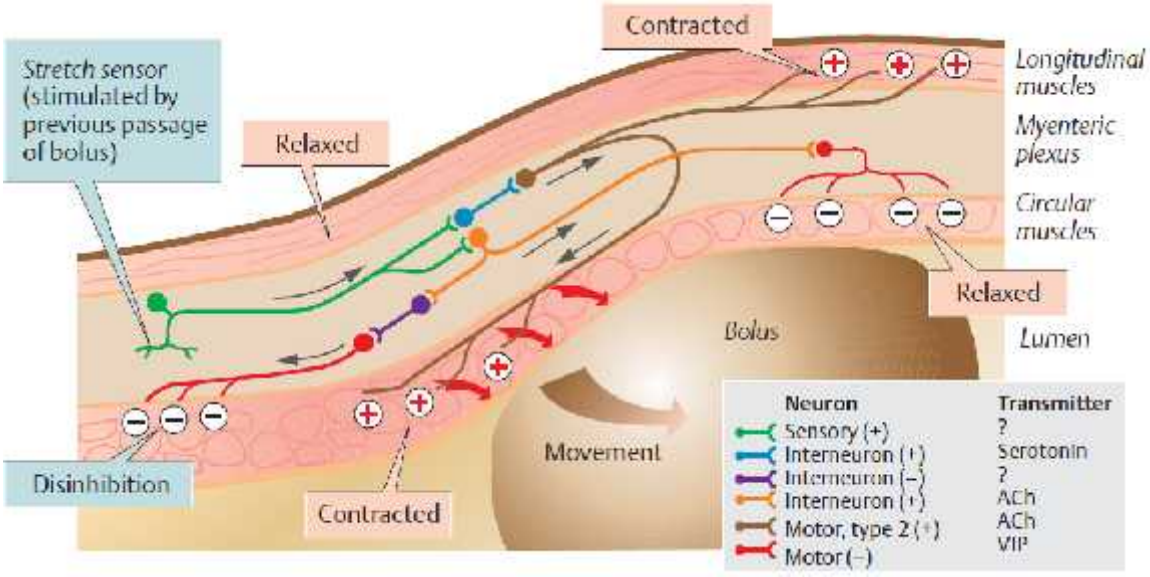
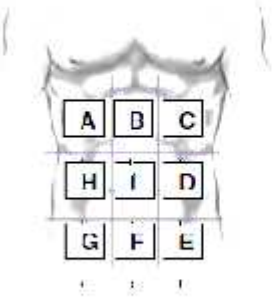


Fig-8 Physiology of peristalsis of the Small Intestine.

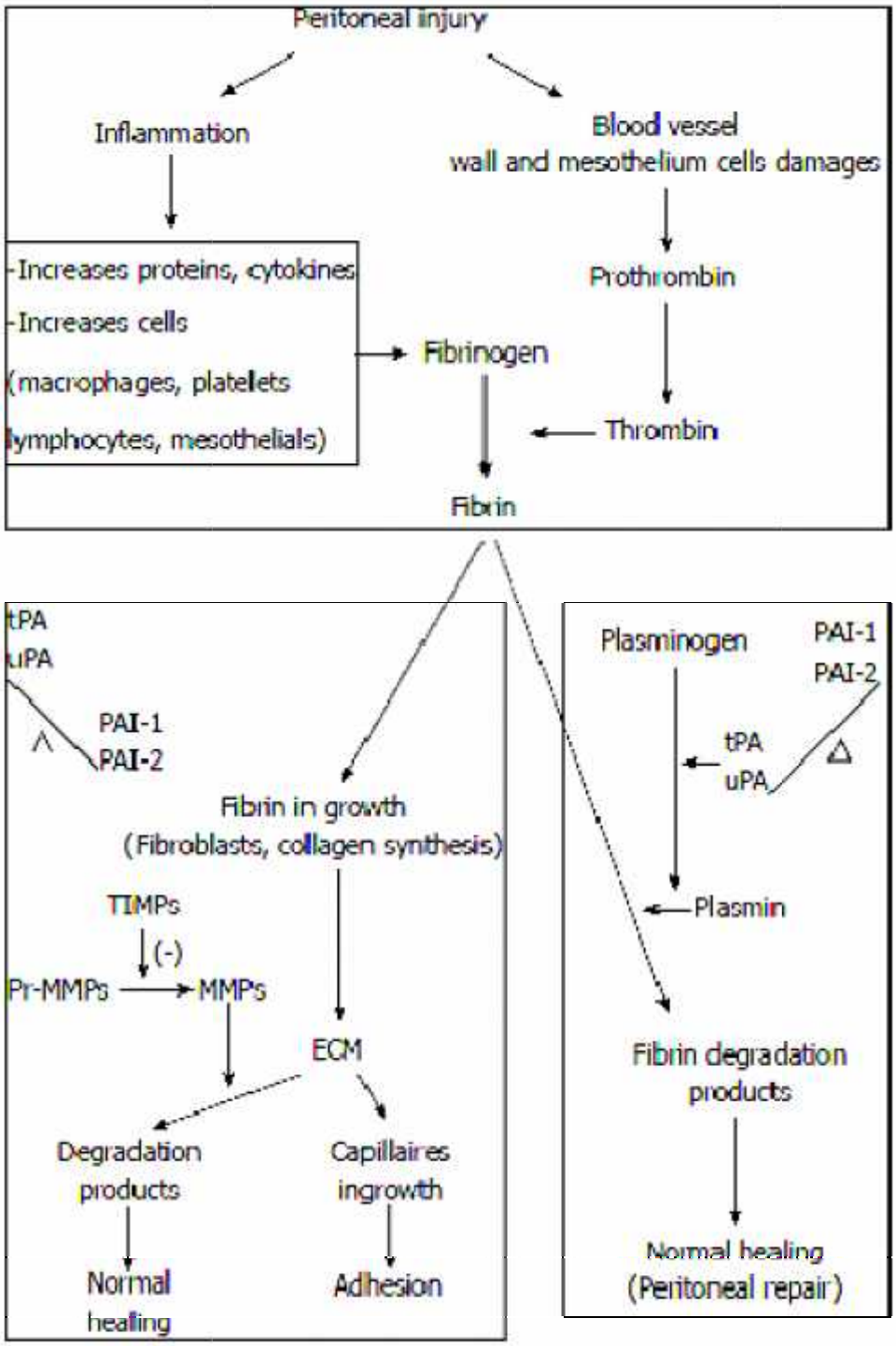
PERITONEAL ADHESION INDEX:



Regions:	Adhesion grade:	Adhesion grade score:
A Right upper	____	0 No adhesions
B Epigastrium	____	1 Filmy adhesions, blunt dissection
C Left upper	____	2 Strong adhesions, sharp dissection
D Left flank		3 Very strong vascularized adhesions, sharp
E Left lower	____	dissection, damage hardly preventable
F Pelvis	____	
G Right lower	____	
H Right flank	____	
I Central		
L Bowel to bowel	____	

PAI ☐

Fig-9 Peritoneal Adhesion Index


Peritoneal injury
Inflammation
Blood vessel
wall and mesothelium cells damages
-Increases proteins, cytokines
-Increases cells
(macrophages, platelets
lymphocytes, mesothelials)
Fibrinogen
Prothrombin
Thrombin
Fibrin
tPA
uPA
PAI-1
PAI-2
Fibrin in growth
(Fibroblasts, collagen synthesis)
TIMPs
(-)
Pr-MMPs
MMPs
ECM
Degradation
products
Capillaires
ingrowth
Normal
healing
Adhesion
Plasminogen
PAI-1
PAI-2
tPA
uPA
Plasmin
Fibrin degradation
products
Normal healing
(Peritoneal repair)

PAI-1 = plasminogen activator inhibitors group 1; tPA = tissue plasminogen activator; uPA= urokinase-like plasminogen activator.

Fig-9: Pathogenesis of Adhesion formation

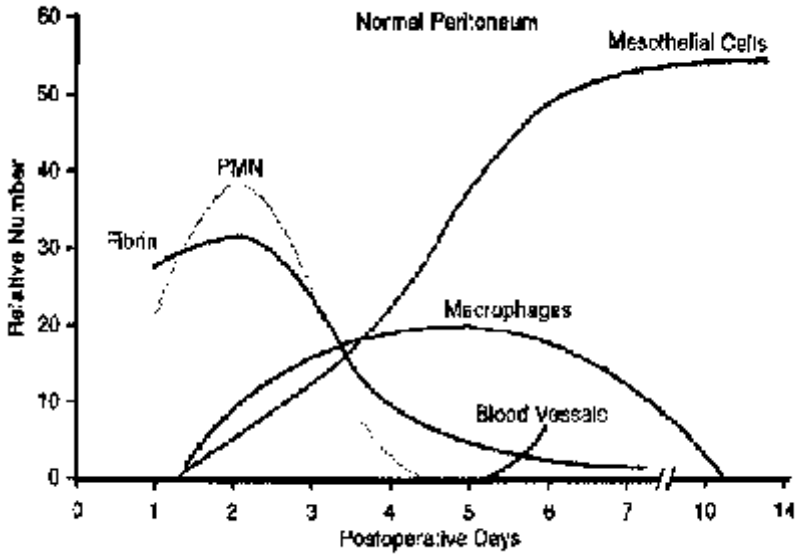


Fig- 10 pathogenesis in relation to post operative period

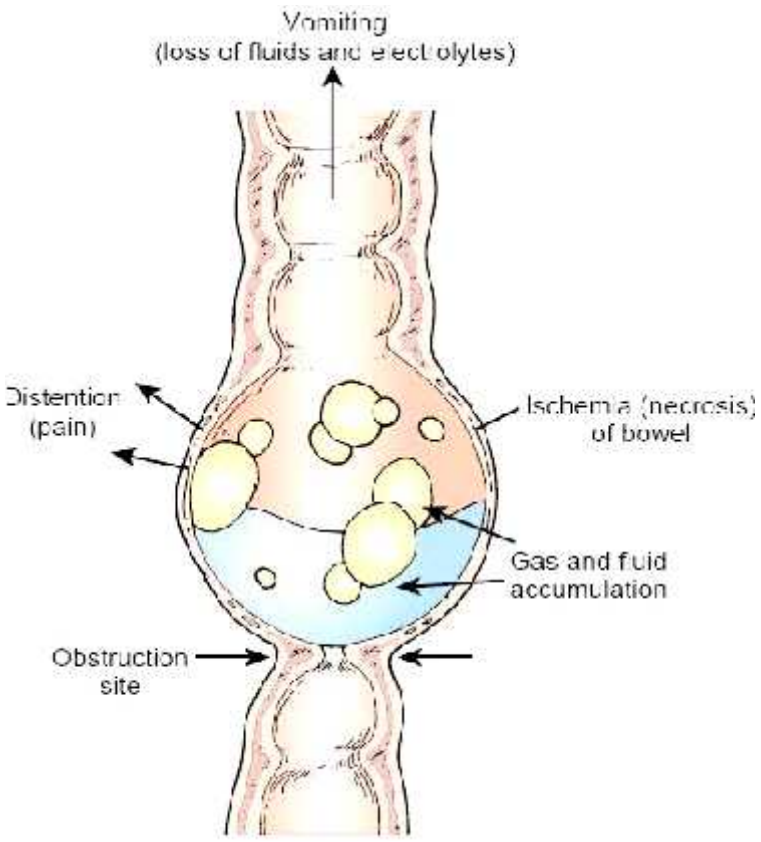


Fig-11- Pathophysiology of obstruction

Fig- 12 Previous Appendicectomy with abdominal distention

Fig-13 Previous LSCS with Incisional hernia with Adhesive Small bowel obstruction

Fig-14- X-Ray with Small Bowel Obstruction (illeal) with Multiple Air fluid Level

Fig-15- X-Ray Jejunal Obstruction with Multiple dilated bowel loops

Fig- 16- Abdominal Cocoon

Fig-17 Adhesions due to Chronic Pancreatitis

Fig-18 Adhesions with stricture due to Abdominal Tuberculosis

Fig-19- adhesions due to abdominal Tuberculosis

Fig-20 Open Adhesiolysis with blunt dissection

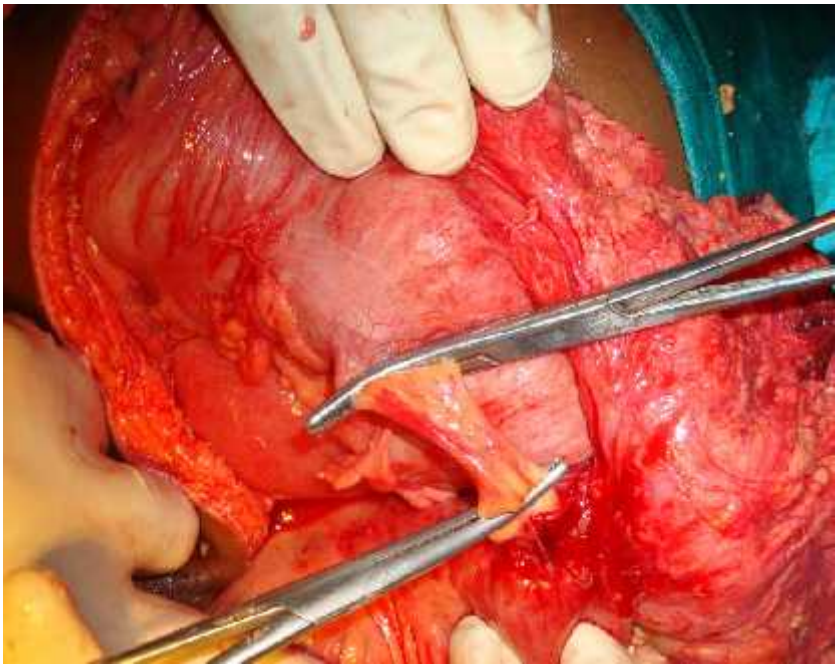


Fig-21 Open Adhesiolysis using sharp dissection

Fig- 22 Small Bowel after Adhesiolysis with serosal damage

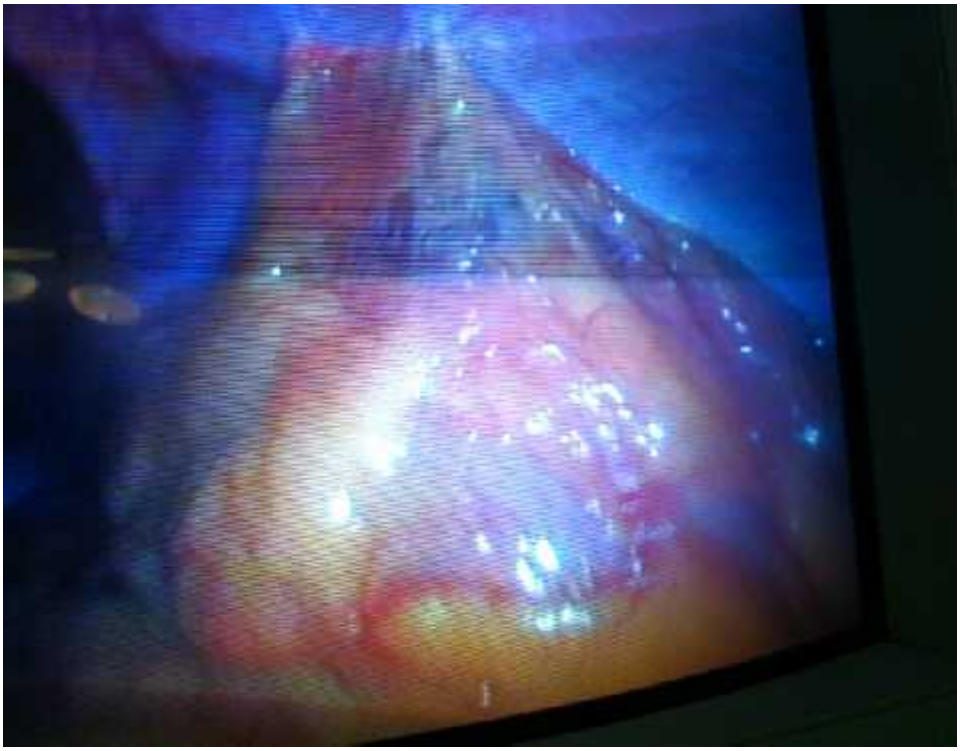


Fig-23 Laparoscopic Adhesiolysis

Fig-24 Seprafilm

Fig-25 Seprafilm adhesion barrier being applied

STUDY DESIGN

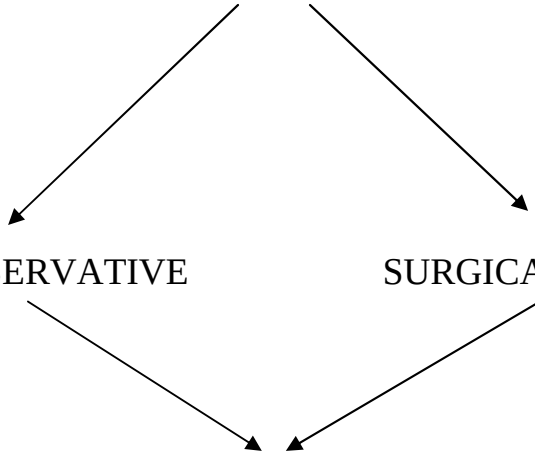
OBSERVATIONAL STUDY

Sample size

POST OPERATIVE ADHESIVE SMALL BOWEL OBSTRUCTION

Sample size – 100

Five Symptoms analyzed



CONSERVATIVE SURGICAL TREATMENT

HYPOTHESIS FORMULATED

SCORING FOR SYMPTOMS ASSIGNED

TO BE SUBJECTED FOR RCT FOR ITS SIGNIFICANCE